Aviation Week
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A McGraw-Hill Publication

September 4, 1961

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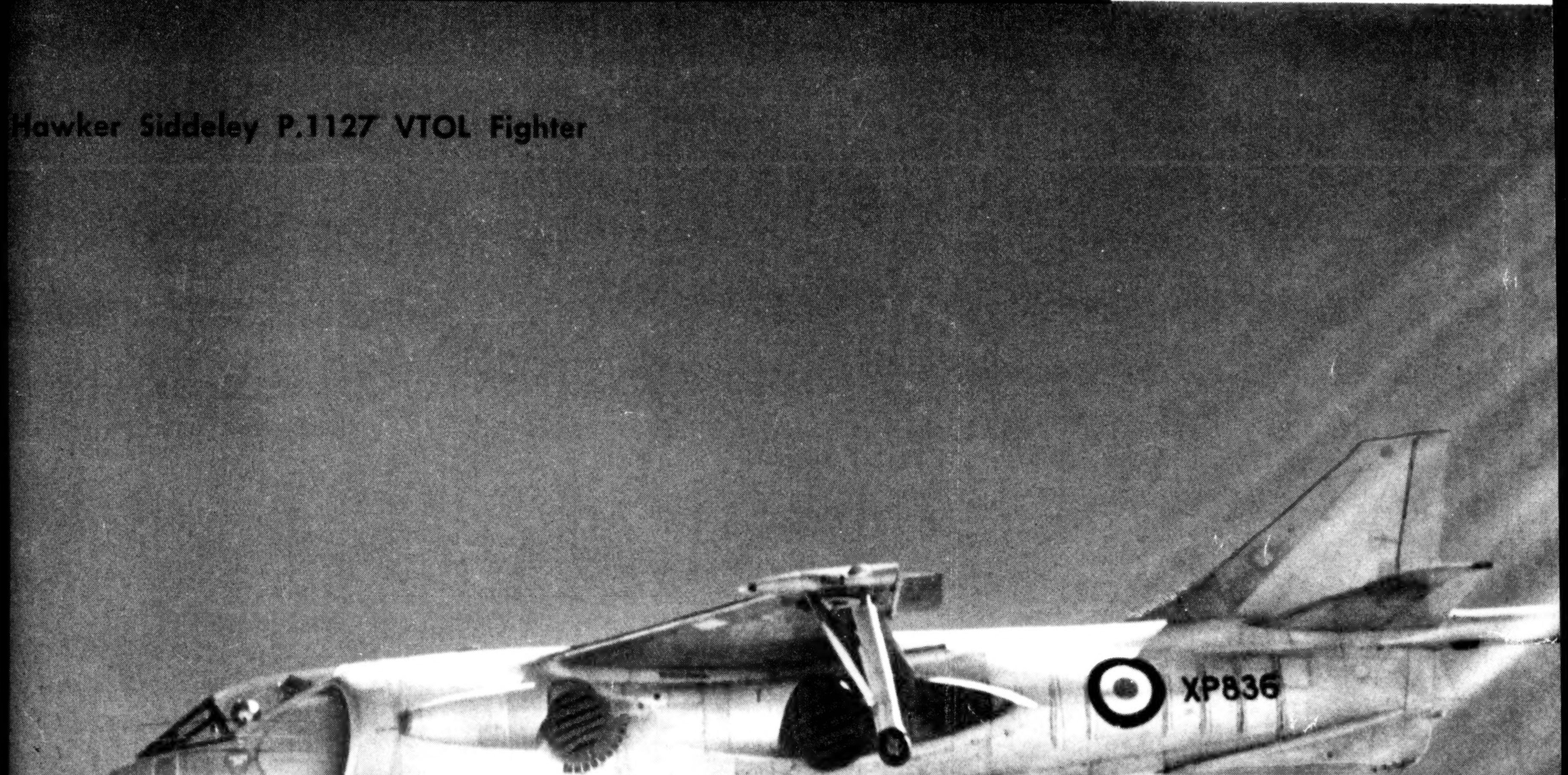

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Sept. 10-12—National Convention, National Aeronautic Assn., Westbury, N. Y.

Sept. 11-15—16th Annual Instrument-Automation Conference & Exhibit, Instrument Society of America, Biltmore Hotel and Los Angeles Sports Arena, Los Angeles.

Sept. 13-14—International Operations and Maintenance Symposium, Airwork Corp., Millville, N. J.

Sept. 13-15—16th Annual Meeting, Armed Forces Chemical Assn., Statler-Hilton Hotel, Washington, D. C.

Sept. 14-15—Ninth Annual Joint Societies Engineering and Management Conference, IRE, Hotel Roosevelt, New York.

Sept. 14-15—Conference on Technical-Scientific Communications, Institute of Radio Engineers, Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.

Sept. 18-20—10th Annual Meeting, Standards Engineers Society, Hotel Sherman, Chicago, Ill.

Sept. 20-21—Industrial Electronics Symposium, Institute of Radio Engineers, Bradford Hotel, Boston, Mass.

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium and

(*Continued on page 6*)

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September 4, 1961

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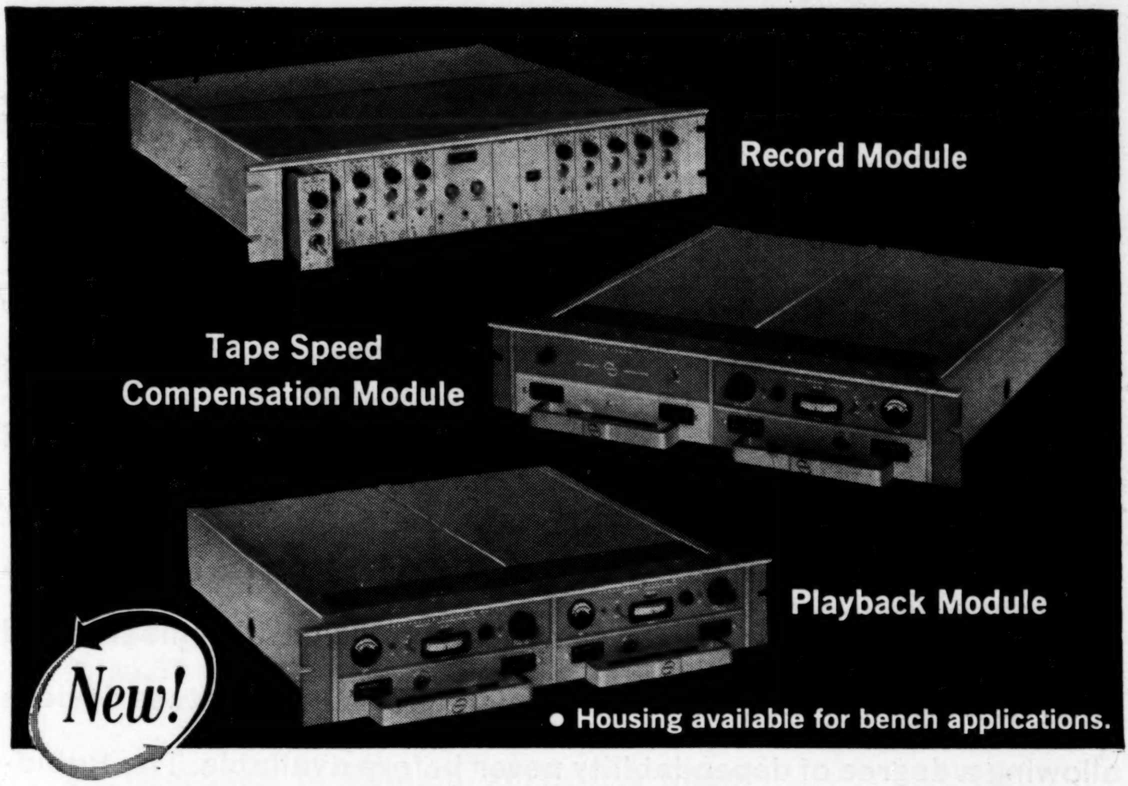
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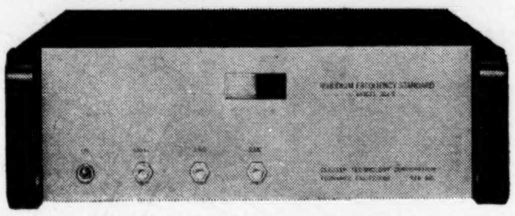

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## AVIATION CALENDAR

*(Continued from page 5)*

Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

**Oct. 2-4**—Seventh National Communications Symposium, Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

**Oct. 2-7**—12th International Astronautical Congress, Washington, D. C.

**Oct. 3-5**—National Airports Conference, University of Oklahoma, Norman, Okla.

**Oct. 4-6**—Semi-Annual Convention, American Society of Photogrammetry, Biltmore Hotel, New York, N. Y.

**Oct. 9-11**—Mid-Year Conference, Airport Operators Council, Hilton Hotel, El Paso.

**Oct. 9-11**—National Electronics Conference, International Amphitheatre, Chicago, Ill.

**Oct. 9-13**—National Aerospace Engineering & Manufacturing Meeting, Society of Automotive Engineers, Ambassador Hotel, Los Angeles, Calif.

**Oct. 9-15**—American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Coliseum, New York, N.Y.

**Oct. 9-15**—Aircraft Owners & Pilots Assn. Convention, St. Petersburg, Fla.

**Oct. 10-12**—Second Conference on Nuclear Reactor Chemistry and Fifth Conference on Analytical Chemistry in Nuclear Reactor Technology, Gatlinburg, Tenn. Sponsor: Oak Ridge National Laboratory.

**Oct. 14-22**—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janeiro, Brazil.

**Oct. 16-19**—Eighth Annual Symposium, American Vacuum Society, and Second International Congress, International Organization for Vacuum Science and Technology, Sheraton-Park Hotel, Washington, D. C.

**Oct. 19**—General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Ill.

**Oct. 23-24**—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

**Oct. 23-25**—East Coast Conference on Aerospace and Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

**Oct. 23-27**—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

**Oct. 24-26**—International Symposium on Aero-Space Nuclear Propulsion, IRE, Riviera Hotel, Las Vegas, Nev.

**Oct. 24-26**—Air Transport Assn.'s Engineering and Maintenance Operators Meeting, Americana Hotel, Miami Beach, Fla.

**Oct. 26-27**—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Sahara Hotel, Las Vegas, Nev.

**Oct. 26-27**—Third Annual Symposium on High-Speed Testing, Hotel Somerset, Boston, Mass. Sponsor: Plas-Tech Equipment Corp.

**Oct. 30-Nov. 1**—Annual Meeting, Air Traffic Control Assn., Deauville Hotel, Miami Beach, Fla.

**Nov. 1-3**—"Issues and Challenges of Air Transportation" Symposium, Hartford, Conn. Sponsor: Connecticut General Life Insurance Co.

**Nov. 6-8**—Special Technical Conference on Non-Linear Magnetics, Institute of Radio Engineers, Statler Hilton Hotel, Los Angeles, Calif.

September 4, 1961

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## and Space Technology

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**USAF Seeks $71 Million for Pluto Program**........ **26**
▶ Some congressmen skeptical over attitude of defense; extra funds would accelerate nuclear ramjet for Slam.

**Passenger Fare Cuts Expected to Spread**.......... **38**
▶ Industry hopes to arrest downward swing in traffic but splits over what types of special rates to use.

**Farnborough to Remain All-British Show**......... **78**
▶ Britain's aviation industry will keep its Farnborough show a strictly British activity despite British international involvement.

### SPACE TECHNOLOGY

**USAF to Seek $71 Million for Pluto**... **26**
**NASA Schedules Additional Rangers**.. **28**
**Cape Canaveral Enlargements Mapped** **28**
**Soviet Space Gain Threat**.......... **29**
**Communications Satellite System**.... **32**
**AT&T Role in Communications Satellites** **32**
**Micrometeoriod Satellite Falls**...... **33**
**Scout to Be Used as Testbed**........ **34**
**Titov Discusses Vostok Flight**....... **34**
**Manned Orbital Assembly Program**.. **60**
**Simulator Tests Space Controls**...... **63**

### MISSILE ENGINEERING

**Large Aerojet Solid Booster Firing**... **29**
**Problems May Cut Polaris A3 Goal**... **31**
**Process Provides High-Pressure Cases**. **69**

### AERONAUTICAL ENGINEERING

**Wind Tunnel Compressor Fails**....... **32**
**Navy Large Seaplane Interest Increases** **33**
**Tri-Service Team Recommended**..... **36**
**F4H Speed Record**................. **36**
**Wind Tunnel Data on Lockheed C-141**. **39**
**Rolls Increases Turbine Experience**... **52**

### AVIONICS

**Airborne Thermoelectric Systems**.... **71**
**Infrared Horizon Indicator**......... **72**
**Filter Center** ...................... **73**

### EQUIPMENT

**Spur Nuclear Space Powerplant**..... **56**
**Production Briefing** .............. **57**

### AIR TRANSPORT

**Passenger Fare Cuts Expected to Spread** **38**
**FEIA-National Sign Wage Pact**....... **38**
**Air Taxis Request New Service**...... **40**
**Halaby to Refurbish Ground Facilities**. **41**
**National Reports Loss**.............. **41**
**Supplemental Air Carrier Status**..... **41**
**Southern Airways-ALPA Dispute**..... **41**
**Class Mail Rates Increase Profits**.... **43**
**Domestic Air Freight Minimums**..... **43**
**Carvairs Slated for Swiss Routes**..... **46**
**Aeroflot Urged to Raise Efficiency**.... **47**
**Airline Income and Expenses—June**.. **48**
**Airline Observer** ................. **49**
**Shortlines** ....................... **49**

### MANAGEMENT

**Berlin Flight Escorts Planned**....... **35**
**Farnborough to Remain All-British Show** **78**
**Europeans to Keep USAF Overhaul Work** **82**
**New Offerings** .................... **74**
**Who's Where** ..................... **23**
**Industry Observer** ................. **23**
**Washington Roundup** ............. **25**
**News Digest** ..................... **37**

### BUSINESS FLYING

**Wichita Sailplane Demonstration**.... **67**
**Augusta-Bell 204 Versatility**........ **67**

**Calendar** ........................ **5**
**Letters** ......................... **98**

### EDITORIAL

**The Nuclear Shoe Drops**........... **21**

**COVER:** Second prototype of the Hawker Siddeley P.1127 VTOL fighter, which made its initial flight July 7, simulates the transition phase at 10,000-ft. altitude, with jet nozzles turned to about 70-deg. position. Current test program, accelerated for NATO competition, is split between two aircraft, one performing high speed testing and the other investigating low speed regimes.. The aircraft is powered by a Bristol Siddeley BS. 53 forward fan turbojet producing about 15,000 lb. thrust (AW Apr. 4, p. 93).

**PICTURE CREDITS**

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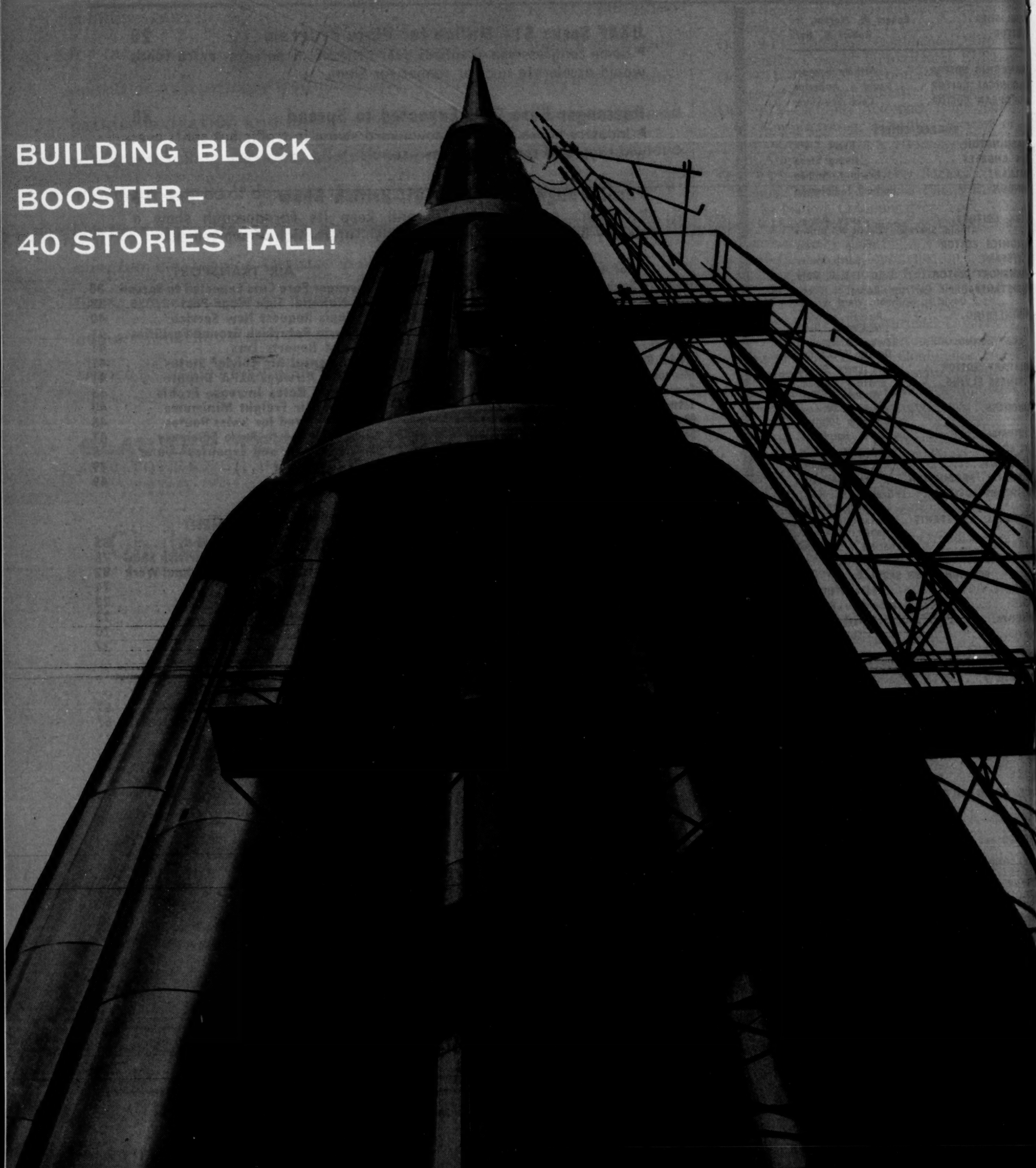

# EDITORIAL

## The Nuclear Shoe Drops

Soviet Union's announcement that it is officially resuming nuclear weapons testing which probably will include the newly designed 100-megaton warhead should come as no surprise to readers of Aviation Week. More than a month ago we warned that the Soviets would follow their Tushino air show surprises with more shocks to the West, and this time in the area of nuclear weapons. In Aviation Week of July 24 (p. 21), as part of an editorial titled "Another Surprise Coming?" we wrote as follows:

"However much of a shock it is to the American people to discover that the Red Air Force, which was supposed to be fading into obsolescence, had suddenly blossomed out with a full array of new generation aircraft across the whole technical spectrum from supersonic bombers and long-range interceptors to assault transports and helicopters, we wonder if an even greater shock may not be in the offing. We wonder if the self-imposed ban on nuclear testing that the United States has been operating under for the last three years may not be leading toward the dissipation of our once commanding lead in nuclear weapons development. Will we wake up another Monday morning soon and find that the Soviets have been secretly testing new generations of nuclear weapons when they confront us publicly with their operational capability?"

The Soviets have now done just that. It was no coincidence that they first proposed their ban on further nuclear testing almost immediately after they concluded the largest series of nuclear tests in their history. These shots presumably provided sufficient proof testing of new nuclear weapon designs to keep Soviet production facilities humming while their scientists settled down to designing the next generation of nuclear weapons that would not require proof testing until the 1961-62 period. Thus the Soviets got a free ride for their supposedly humanitarian gesture during a period when they required no large-scale atmospheric testing, anyway. The U.S. accepted the Soviet gambit, literally ceased all kinds of nuclear weapons testing and imposed an artificial three-year delay that ran counter to our own development requirements, both for larger yield ICBM warheads and smaller battlefield weapons in the lower kiloton ranges.

### Soviet 'Newspeak'

Now that the test ban no longer suits their practical purposes, the Soviets cynically drop their humanitarian pose and tell the world they are going to test the biggest mass destruction weapons of all time—weapons that probably also will produce a new high in atmospheric contamination and widespread fallout. Their public excuse for this swift about face is couched in the best phrases of "Newspeak," the Orwellian language of the novel "1984," in which war is peace and peace is war, black is white and white is black. Unloosing the new horror of a 100-megaton weapon, according to the Soviets, is done only in the interests of world peace and was forced upon them by the "capitalistic warmongers' " actions in defending themselves against the latest Soviet squeeze on Berlin.

It is a well known fact that Soviet submarines and electronically equipped trawlers have been plying the sensitive seas around the Atlantic and Pacific missile test ranges and elsewhere along our coasts to enlarge their knowledge of our defenses and the environment for their offensive weapons. The Soviets have complained bitterly about the identification of these "peaceful fishermen in international waters" by U.S. Navy patrol planes. Now that U. S. nuclear-powered submarines armed with Polaris missiles are beginning to appear on station around the Soviet perimeter, the Russian propaganda machine has begun to howl about "spying foreign submarines" and to threaten them with destruction. All of this bald Soviet cynicism follows a long-established pattern but unfortunately there are some Americans who still can be deluded by these Soviet maneuvers.

The military requirements of the U. S. and the Soviet Union are vastly different, and no doubt there will be a protracted argument by the learned military experts in the Congress, the press and the pulpit over whether possession of a 100-megaton bomb and the ballistic missile delivery system to put it on target offers the Soviet Union any significant military advantage. Unfortunately, most of this argument will be premised on our own military requirements and foreign policy and not on that of the Soviet Union.

### Satellite Terror

The 100-megaton warhead and its delivery system offer a fine new tool for the Soviet game of bluster, threats and international blackmail. More than a year ago we also warned that the Soviets would proceed from their missile rattling to space satellite rattling as soon as they produced the required hardware. They now have all of the hardware elements to practice satellite blackmail in the very near future. The 100-megaton weapon adds another increment of horror to the nuclear arsenal, the rockets they have already demonstrated can hurl this new weapon into orbit (perhaps with a man aboard to control it), and precise re-entry techniques that could bring it back onto a terrestrial target, with no currently known means of defense against it, have been demonstrated.

Some will argue that this is an inefficient method of delivering this weapon to a target, and indeed it may be. But the real value of a weapon of terror such as the Soviets now are constructing is not in its actual use but in its psychological effect on the people over whom it is dangled like a Damoclean sword. We wonder what the effect would be on the populace below of a series of brightly painted Vostoks orbiting above every few hours and broadcasting messages to earth that this is "your friendly Soviet astronaut number so-and-so with a 100-megaton warhead aboard ready to go any time anybody opposes the 'peaceful policies' of the Soviet Union."

When will this country wake up to the character of the struggle for survival in which we are already heavily engaged and the nature of the beast that is leaping for our jugular?

—Robert Hotz

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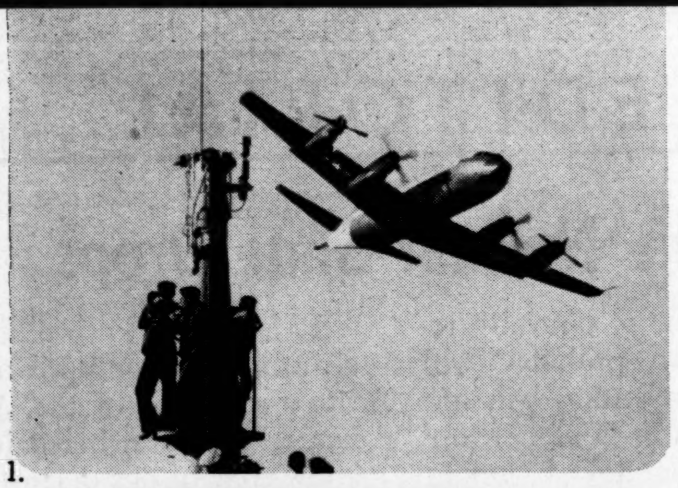
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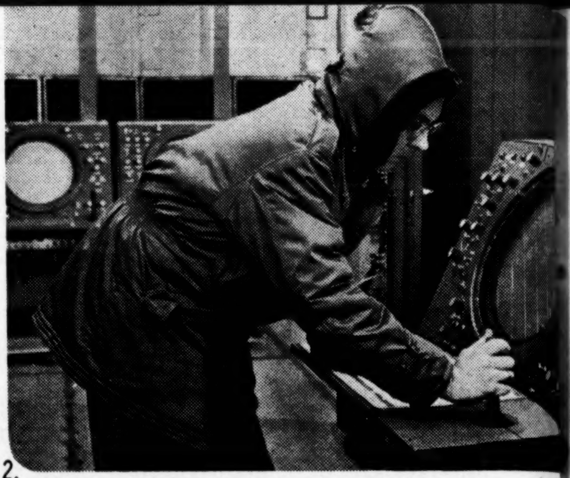
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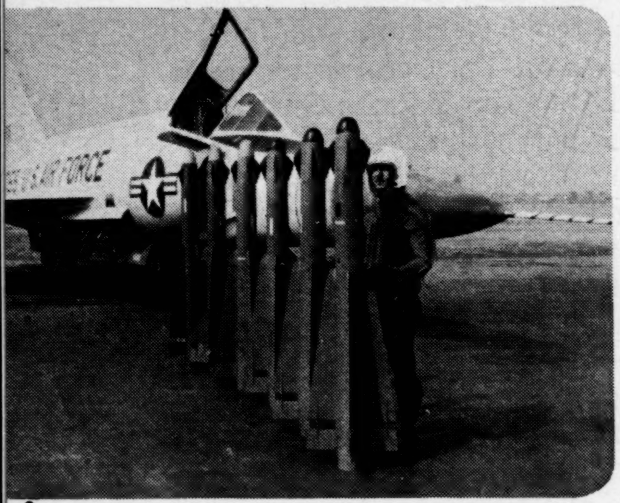

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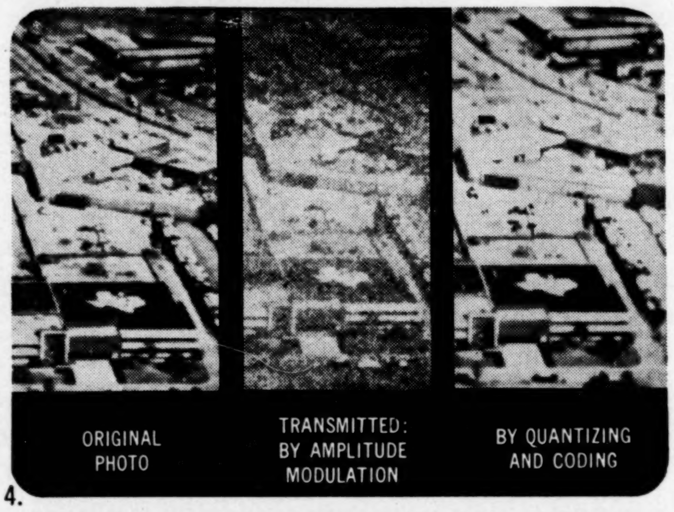

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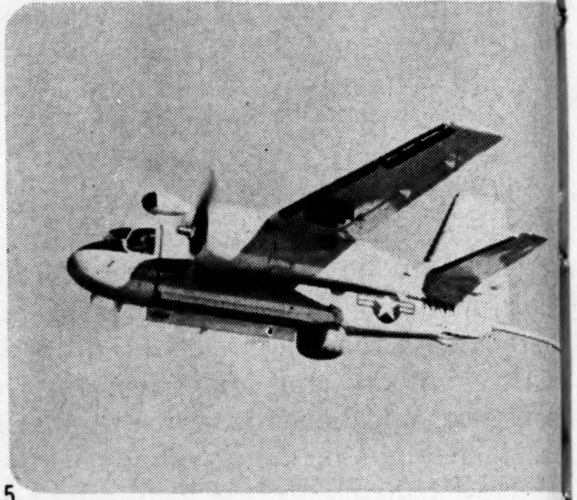
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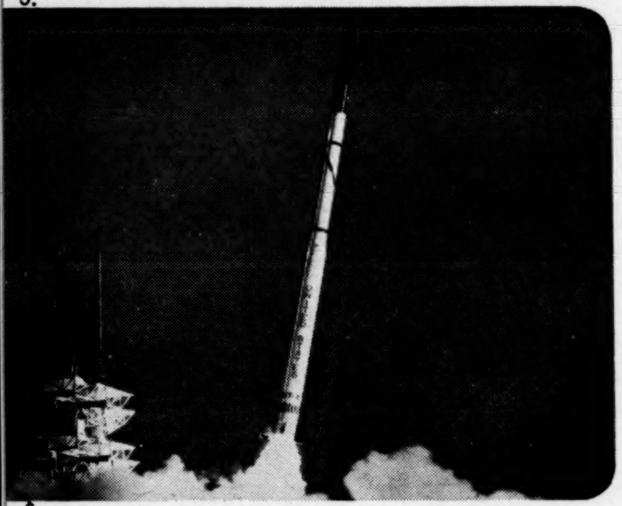
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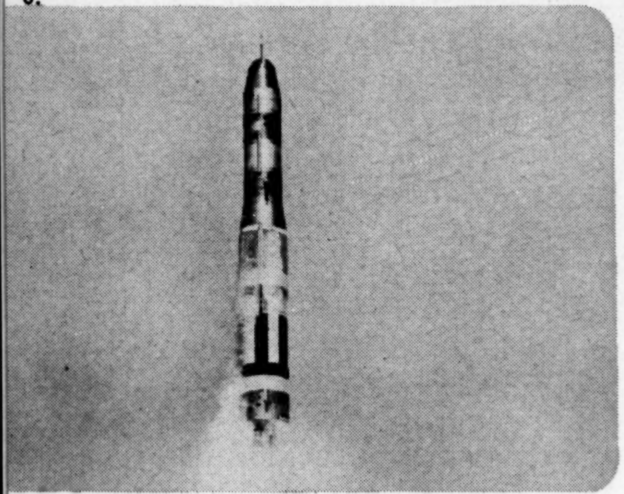
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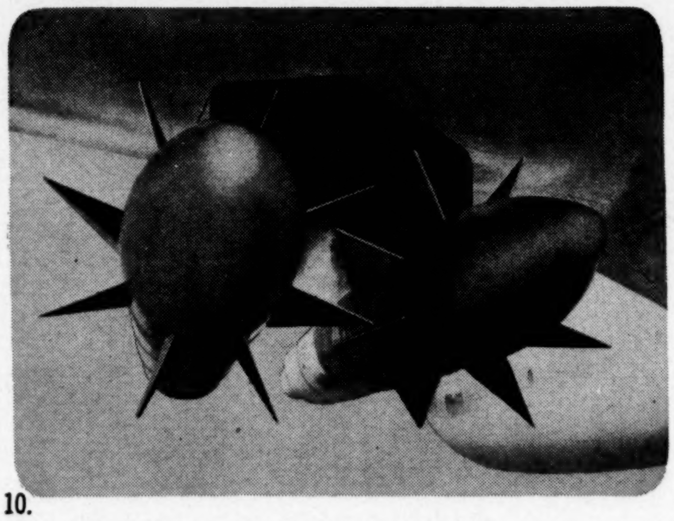
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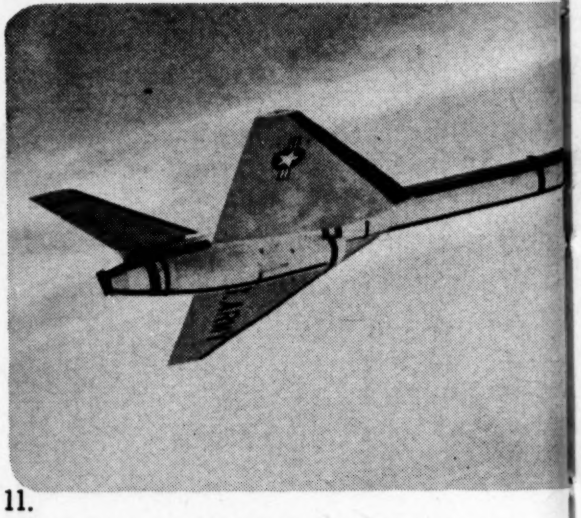
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**Equipment, designed, developed and manufactured by TI now operational in the Armed Forces:**

1. U. S. Navy P3V-1 antisubmarine aircraft produced by Lockheed—equipped with AN/APS-80 surface search radar, AN/APA-125A indicator, and additional gear (nomenclature classified).
2. TARmac ASR-4 Airport Surveillance Radar for the Federal Aviation Agency.
3. Infrared optics for the U.S.A.F. FALCON Air-to-Air Missile, built by Hughes.
4. Quantized photograph, transmitted by PCM code, results in faithful transmission and improved reproduction over great distances.
5. AN/APS-381 surface search radar, AN/ASQ-8 magnetic anomaly detector for the U. S. Navy S2F-1 ASW aircraft, built by Grumman.
6. TI programs 12 different flight functions in Minneapolis-Honeywell guidance and control for NASA's SCOUT space vehicle — produced by Chance Vought.
7. AN/AQS-4 and AN/AQ5-S dipping sonar for the U. S. Navy HSS-1N ASW helicopter, built by Sikorsky.
8. TI developed FM/FM transmitters and power supplies operated in "Ham" MERCURY spacecraft test. TI will supply FM/FM systems for later MERCURY shots.
9. Programmers for the U.S.A.F. TITAN Intercontinental Ballistic Missile, built by Martin.
10. Sidereal timers and ground equipment developed and built by TI provide highly accurate reference time for the U. S. Air Force SKYBOLT missile —designed and built by Douglas Aircraft Company.
11. Surveillance sensors for the U. S. Army Signal Corps AN/USD-5 combat drone, produced by Fairchild.

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# WHO'S WHERE

## In the Front Office

**V. G. Nielsen,** elected to the Board of Trustees of Aerospace Corp., Los Angeles, Calif. Prior to retirement, Mr. Nielsen was a vice president of Thompson Ramo Wooldridge, Inc.

**David S. Lewis,** corporate vice president and general manager, McDonnell Aircraft Corp., St. Louis, Mo.

**Dr. Theodore K. Steele,** executive vice president, Bulova Research & Development Laboratories, a division of Bulova Watch Company, Inc., Woodside, N. Y., succeeding **Mell A. Peterson,** now special assistant to the company executive vice president.

**D. J. Harnett,** vice president and counsel, United Industrial Corp., Los Angeles, Calif.

**Dr. William F. Ballhaus,** executive vice president, Northrop Corp, Beverly Hills, Calif., and **Frederick Stevens,** a corporate vice president. Mr. Stevens will succeed Dr. Ballhaus as general manager of the Nortronics Division. Other Nortronics Division appointments: **Frank Lynch,** vice president and manager, Electronics Systems and Equipment Department, and **Ross Miller,** assistant manager and chief engineer.

**W. W. Smith,** vice president-engineering, Babcock Electronics Corp., Costa Mesa, Calif.

**Robert C. Hench,** board chairman, International Air Service Company, Ltd., Burlingame, Calif. **William C. Rivers** succeeds Mr. Hench as president.

**Frank D. Banta,** assistant vice president and an officer of General Precision, Inc., Tarrytown, N. Y. Mr. Banta will continue as director of program management.

**Robert C. Chilton,** secretary and contracts administrator, Space Equipment Corp., Torrance, Calif.

Maj. Gen. **Arthur F. Binney** will become Deputy Commander, Fleet Marine Force, Atlantic, Norfolk, Va., replacing **Maj. Gen. Richard C. Mangrum** who will become Commanding General of the Second Marine Aircraft Wing, Cherry Point, N. C., replacing **Maj. Gen. Ralph K. Rottet** who will become Director, Marine Corps Educational Center, Marine Corps Schools, Quantico, Va.

**Brig. Gen. Ethan A. Chapman** (USA) will become Commanding General, XII Corps, Atlanta, Ga. **Brig. Gen. John H. Daly** will replace Gen. Chapman as Assistant Deputy Chief of Staff for Plans, North American Air Defense Command, Ent AFB, Colorado Springs, Colo. Also: **Brig. Gen. Edward L. Rowny** will become Assistant Division Commander, 82d Airborne Division, Fort Bragg, N. C.

## Honors and Elections

**W. John Beil,** director of Space Technology Laboratories' Nike-Zeus Target Program Office, has been awarded the Air Force Scroll of Appreciation for his contributions to Project SCORE.

**Dr. Ernest R. Roberts,** assistant manager of Aerojet-General Corp.'s Solid Rocket plant, has been awarded the Navy's Meritorious Public Service Citation for his work on the Polaris Fleet Ballistic Missile.

*(Continued on page 75)*

# INDUSTRY OBSERVER

▶National Aeronautics and Space Administration expects research and development on the Apollo spacecraft to be completed in 1963 and evaluation of it to be concluded the following year. The first manned earth orbital shot is scheduled to take place in 1964 and an unmanned circumlunar flight in 1965. Manned circumlunar flight also is expected in 1965, and the first manned landing and return in 1967. Lunar landing will take place in the Sea of Tranquility area.

**▶Number of Apollo bidders have formed teams, narrowing the list of apparent top contenders to five. They are Martin and North American Aviation and the following teams: General Dynamics-Avco; General Electric-Grumman-Space Technology Laboratories-Douglas; McDonnell-Vought-Lockheed.**

▶Confirmation of theoretical calculations for skin heating of supersonic transports has been obtained in flight tests of North American's X-15 research aircraft. Peak temperatures of 800F have been recorded near the mid-span leading edge during flight at Mach 3 and 70,000 ft.

**▶Target date for installation and operation of USAF's new Nuclear Detection System (NUDETS) is early 1963. System will include sensors located at strategic points around the U. S. to locate and measure yield of nuclear blasts, and central computers to correlate information. Companies expected to bid on the 477-L system contract, as a result of earlier unfunded studies for NORAD, include General Dynamics/Ft. Worth, Hughes Aircraft, Laboratory for Electronics, Raytheon, Radio Corp. of America, Southwestern Industries Electronics, and Thompson Ramo Wooldridge.**

▶Both the Atlas E, now in Category II weapon system tests at Vandenberg AFB, Calif., and the Atlas F, now in research and development flight testing at Cape Canaveral, Fla., will carry decoys in their nose cones.

**▶Plan to launch a Mercury communications package aboard a Scout rocket to test the Mercury communications network has been revived by NASA and is tentatively scheduled for Sept. 19.**

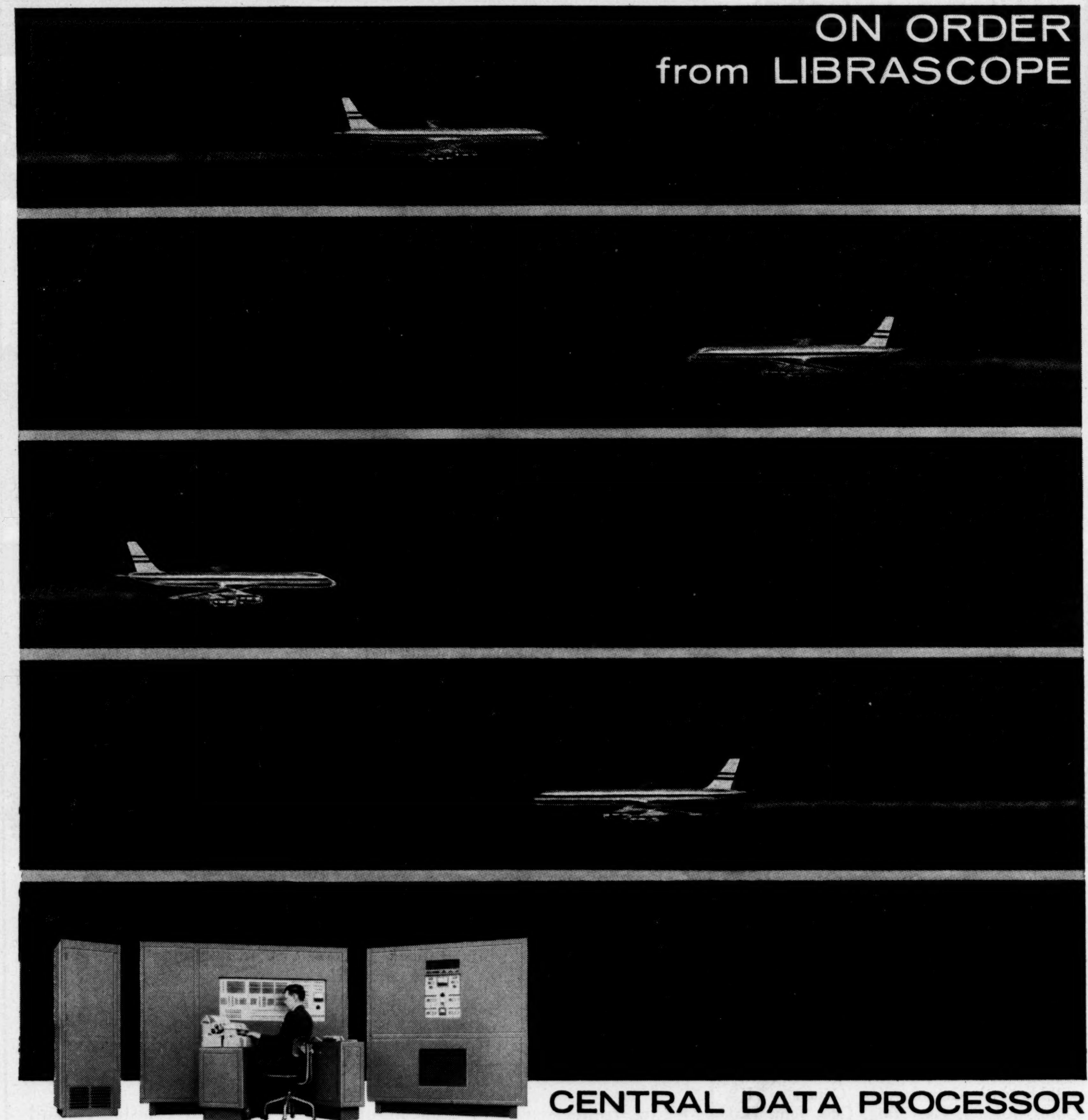
▶Watch for a NASA-Atomic Energy Commission decision soon on whether fuel elements for the Nerva nuclear rocket engine will be made at AEC's Los Alamos Scientific Laboratory or contracted to industry. Los Alamos has the capability to make elements on a laboratory scale but production rate would have to be expanded greatly to cope with the planned Nerva engine production rate of three or four per year.

**▶Republic Aviation has proposed to NASA a series of re-entry vehicle shape tests. Proposal suggests a total of nine vehicles—an actual shot, a backup and a type test vehicle for each of three different shapes.**

▶Live tissues sent into orbit in unshielded aluminum canisters aboard recoverable USAF Discoverer satellite capsules have shown surprisingly little damage from radiation. Succeeding generations of the organisms have revealed no genetic aberrations. This indicates that heavy shielding, which stops cosmic rays and neutrons and produces atomic disintegration in the shielding material, might be more harmful in some cases than no shielding.

**▶More Convair Atlas missiles have been assigned to space programs than the total assigned both to research and development firings and to operational USAF sites. Atlas missiles beyond 88-D were modified to meet the varying requirements of space missions. Modifications include a heavier-gage skin over the forward part of the body.**

▶USAF-Martin Matador missiles, returned from operational squadrons after they were replaced by TM-76A Mace models, were made into target drones for about $3,000 per unit. About 120 were converted at Air Force Missile Development Center and fired in test programs. About 85% were considered good targets.



## CENTRAL DATA PROCESSOR for AIR TRAFFIC CONTROL

Today, at a peak traffic hour, approximately 200 aircraft flew over the New York area. Each year this number will increase. Yet, the Federal Aviation Agency will continue to assure safe and efficient control of air traffic. One reason . . . a data processor developed for the FAA by Librascope to quickly and accurately handle the routine clerical tasks now occupying most of the controller's time. The first 18-unit data processor will be installed at Boston in 1962. A note to Librascope outlining your control problems will bring a prompt answer from the country's most versatile manufacturer of computer control systems.

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# Washington Roundup

## Saturn Competition

**Industry is pressing hard to get a systems management contract for the Saturn space booster, once assembly and test of the S-1 first stage moves out of what it calls "the NASA arsenal"** at Huntsville, Ala., and into a contractor operation. NASA expects to select an A&T contractor soon—possibly by late this week.

**Although NASA wants industry to use a World War II tank plant near Michoud, La., for the assembly job, some companies still prefer other sites.** Estimates put the S-1 contract potential at more than $1 billion, since the winner of that competition is expected to have an edge in bidding for the S-1B. It will use two F-1 engines rather than the eight H-1s that will power the earlier first stage.

**As indications of the intense competition within industry for the job, Boeing is considering leasing 100 acres in Oregon for an assembly and test site, and Ford's** Aeronutronic Division has sent a team to survey the Michoud plant. Boeing also has decided to forego bidding for the Apollo spacecraft in order to concentrate on S-1, and has shifted Dr. George Stoner, who was managing the company's Dyna-Soar work, to direction of the competition for S-1.

## Berlin Airlift

**If another Berlin airlift should be required (see p. 35), the Douglas C-124 Globemaster would become the workhorse aircraft. In the 1948-49 airlift to Berlin,** the heavy work was done by Air Force and Navy with the Douglas C-54 (R5D). Now, however, the greatly expanded inventory offers greater variety, including Douglas C-121s, a limited number of C-133s, and the venerable C-47; Lockheed C-118s and C-130s; and the Convair C-131. Many of the C-54s and R5Ds used in 1948-49 still reveal traces of coal dust during overhaul.

**Opposition to Project West Ford expressed at the recent convention of the International Astronomical Union will not keep Defense Department from proceeding with plans** to place 70 lb. of hair-like metal dipoles in orbit to serve as an artificial ionosphere at microwave frequencies. The White House already has assured astronomers that it will consider their needs before deciding whether to orbit an operational belt of needles, but the IAU passed a resolution opposing even the first experiment "until the question of the permanence [of the orbiting dipoles] is clearly settled." Air Force is trying to develop materials that will sublimate in the space environment so a belt could be given a determinable lifetime.

## Space Council Hiring

**National Aeronautics and Space Council has begun the buildup of its technical staff by hiring Dr. Charles S. Sheldon II** who has been on the technical staff of the House Science and Astronautics Committee since 1958.

**Although he is an economist and transportation expert, his time on the House committee has given him a broad view of the governmental and technical aspects of** space. Dr. Edward C. Welsh, the council's executive secretary, told Aviation Week he does not intend to recruit specialists and assign them to specific technical areas. Instead, he will use the swing system employed by President Kennedy, whereby White House staffers work in a variety of fields.

**The council got the full $320,000 appropriation it asked for, and Welsh said he expects to have a staff, including clerical help, of 18 or 20 people by the end of this** fiscal year. He also hired Henry G. Edler, president of the National Rocket Corp. in El Segundo, Calif. Sheldon begins work this week, Edler later on.

**House Science and Astronautics Committee, after looking into everything from the metric system to supersonic transports to orbital rendezvous, has called it quits for** this year. No more hearings are scheduled by the full committee.

## New Strategy

**A second attempt is being made to get $450,000 in Defense Department funds to allow National Aeronautic Assn. to sponsor the 1962 international conference of the Federation Aeronautique Internationale and five world aviation championships.** A bill introduced in Congress earlier this year by Rep. Olin Teague has not moved out of the House Armed Services Committee because Defense opposed it.

**Now Sen. Warren Magnuson has introduced a similar bill. It has been referred to the Senate Foreign Relations Committee**—apparently on the theory that national pride and worldwide propaganda implications might make that committee more sympathetic, since Russia holds 108 of the 403 world aviation records compared with 98 held by the U. S.

**Soviet Russia is training 35 Ghanaians as aircraft pilots and engineers and expects to train a total of 149.** They will replace Europeans on the state-owned airways.

**Air Force Systems Command and Air Force Logistics Command, subjected to the Washington passion for reducing all organizational** names to initials or acronyms, come out "SyCo" and "LoCo."

—Washington Staff

# USAF Seeks $71 Million for Project Pluto

## Some congressmen skeptical over attitude of Defense; extra funds would accelerate nuclear ramjet for Slam.

By George C. Wilson

**Washington**—Air Force has set the stage for the fateful decision on the Pluto nuclear ramjet program by asking Defense Department for $71 million for the next two years to develop an engine to power the Slam supersonic, low-altitude guided missile.

Brockway McMillan, assistant USAF secretary for research and development, disclosed in Joint Atomic Energy Research and Development Subcommittee hearings last week that the Air Force has requested the funds so the Pluto program can be continued through the ground-test stage.

Specifically, the Air Force wants $41 million for Fiscal 1963 and $30 million for Fiscal 1964. This compares with the $7 million appropriated in Fiscal 1962 for the Air Force portion of the Pluto program. Next year at this time, McMillan said, Air Force will have to decide whether to continue the program through the flight-test stage.

McMillan took the unusual step of revealing future budget requests to rebut claims by some subcommittee members that the nuclear ramjet project was being downgraded by Defense. Chairmen Chet Holifield (D.-Calif.) of the full Joint Atomic Energy Committee and Melvin Price (D.-Ill.) of the research subcommittee took this view.

After the hearing, Rep. Price told Aviation Week that it still looked as though the nuclear ramjet project might be canceled. "Looks too much like the Aircraft Nuclear Propulsion program to me right now," he said. Rep. Price opposed the canceling of the ANP program by Secretary of Defense Robert S. McNamara earlier this year.

### Brown Non-Committal

Fears about Pluto's future were aroused by the non-committal attitude taken toward it by Dr. Harold Brown, defense director of research and engineering, and by the fact the project has been given a lower priority recently.

Dr. Brown told the subcommittee he wanted to look at the alternatives to Pluto before deciding its future, and said the project "may compete with a number of other possible strategic systems." Rep. Price decried this study of alternatives, claiming, "if we continue this cycle, we will never come up with anything."

## Centaur Launch Slips

**Washington—First flight test of the Atlas-Centaur vehicle has slipped three months because Centaur development problems have caused a stretchout in the ground test program.**

**First flight now is scheduled for February from the Atlantic Missile Range. Series of minor problems in the Pratt & Whitney RL10-A3 engine has slowed development. Faulty ignition system caused an earlier delay of six months in the first flight schedule (AW April 24, p. 27).**

As for Pluto's priority, Col. Ola P. Thorne, Air Force assistant deputy chief of staff for atomic energy research and technology, said it had been downgraded one step—from Category 2 to Category 3. Although this is a less urgent classification, the downgrading is nothing final and does not mean Project Pluto is threatened with cancellation, Col. Thorne said. In fact, he said, Air Force is moving ahead toward the next step—finalizing the design of the test engine.

McMillan, Brown, Col. Thorne, and representatives of the Atomic Energy Commission all hailed the successful test of the Tory IIA-1 ground reactor at AEC's Nevada Test Site last May 14. It is one of a series of test reactors that compose the Pluto program.

McMillan said success of the test "has caused the Air Force to consider a program which could lead to a flight-test vehicle." The development of Pluto through the flight test stage is estimated to cost $500 million, with the Air Force spending $400 million and AEC $100 million.

Brown said the test prompted him to conduct another review of Pluto. He said he has appointed an ad hoc committee to evaluate Pluto to help him with his own recommendation on the program's future.

Brown said the test indicated that "one of the major areas of concern to the Littlewood Committee and the Air Force Systems Command is being solved." The Littlewood Committee evaluated the nuclear ramjet project for Dr. Herbert F. York, President Eisenhower's director of defense research. It concluded that a major uncertainty was the adequacy of the reactor, and said no more emphasis should be placed on Pluto until after the reactor underwent tests.

### New Ad Hoc Group

The new ad hoc committee is headed by Dr. Allen E. Puckett, vice president and assistant group executive of the Aerospace Group, Hughes Aircraft Co. Col. Thorne will be Air Force adviser to the group while Dr. Allen J. Vander Weyden, deputy director of AEC's reactor development division, will be AEC adviser. Members of the committee are: Dr. Howland H. Bailey, Rand Corp.; Joseph G. Beerer, vice president of engineering, North American Aviation; Dr. Arthur T. Biehl, MB Associates; Dr. William Bollay, who has served as Brown's consultant on guided missiles and aeronautics; Carl A. Covington, staff assistant to Brown; Dr. Alexander H. Flax, vice president, Cornell Aeronautical Laboratory; Payne Harris, Los Alamos Scientific Laboratory; Dr. Russell O'Neal, vice president of engineering, Bendix Corp.

Next meeting of the ad hoc committee is slated for Sept. 12. Brown said he hoped to have its final report by the end of September. The Air Force already has briefed the committee on its plans. The committee also has taken field trips to Ling-Temco-Vought, which has conducted Slam studies for USAF; AEC's Lawrence Radiation Laboratory, which is monitoring reactor development, and Marquardt, which is a reactor contractor.

Rep. Price urged Brown to study the recommendations of people working on Pluto as well as the ad hoc committee's report. Rep. Price said previous ad hoc committee reports "did not amount to

## Minuteman Test Fails

**Cape Canaveral—First attempt to fire the USAF Minuteman solid propellant intercontinental ballistic missile over its full range from a silo failed last week when the missile exploded in the silo.**

**Indications were that the missile failed to lift from the bottom of the silo. A similar mishap last December with a Titan missile in a silo at Vandenberg AFB, Calif., resulted in the whole crib being ejected.**

**Fire crews here were unable to approach the site for several hours after the explosion to put out the remaining fire and investigate damage. Five successful tethered Minuteman shots were made, using partial fuel loads, at Edwards in 1959 and 1960.**

much. . . . If you want to kill a program," he said, appointing such a committee "is the way to do it." Brown said all views would be considered.

The Tory IIA-1 test, Col. Thorne said, marked "a singular milestone in the Pluto effort." He said the Air Force now believes "nuclear ramjets may well have the performance capability required to give us the force flexibility desired in the post-1970 time period." Air Force cannot define a system requirement, however, since risks and costs are not yet fully known, he said. "These risks," Col. Thorne said, "are as much concerned with airframe and non-nuclear subsystem development as they are with nuclear components."

AEC Commissioner Robert E. Wilson said over-all Pluto progress "has been satisfactory and results have been encouraging." The Tory IIA-1 test results, he said, have revealed that "the reactor performed better than expected." Wilson said the standing schedule calls for making another test, Tory IIA-2, in late September or October as a backup to the first one. But he said AEC may cancel that test if the Tory IIA-1 stands up satisfactorily when put on full power. Assuming the Tory IIA-1 full power test is successful, the next step will be testing the Tory IIC flight-type reactor. The Tory IIC design has been completed, Wilson said, and procurement of parts started.

Dr. Theodore C. Merkle, associate director of Lawrence Radiation Laboratory, said the Tory IIA-1 test "has exceeded our expectations" and he now feels it will not be necessary to build the core for Tory IIA-2. He also announced detailed results of the Tory IIA-1 test.

With the hoped-for performances listed first and those actually achieved listed second, they are: peak power, 40 mw.-50 mw.; time at peak power, 60 sec.-200 sec.; coolant air flow, 113.5 lb., per second-122, plus or minus 5 lb. per second; inlet air temperature, 400F-400F; maximum fuel element wall temperature, 2,250F-above 2,000F.

Just when the Tory IIC flight-type reactor will be tested has not been disclosed. Col. Thorne said the ground test of the nuclear ramjet engine would be the logical sequel to that test.

## Soviets to Resume Nuclear Tests

**Washington—Soviet Union claimed last week that its scientists have "worked out projects of creating a series of superpower nuclear bombs" with yields equivalent to 20, 30, 50 and 100 megatons and said it would resume experimental testing of nuclear weapons. It blamed the decision on the acceleration of the arms race by the U. S.**

**A White House statement decried the action as creating dangers of world-wide nuclear fallout. It said that any crisis cited by the Russians as the reason for their move was of their own making. Chief U. S. negotiator Arthur H. Dean, was recalled from test ban talks in Geneva. It was indicated that President Kennedy would wait for the impact of Russia's plan to sink in around the world before announcing any decision to resume U. S. tests.**

**Severest reaction to the blunt Soviet announcement came at the conference of non-aligned nations, which began last Friday at Belgrade, Yugoslavia. National leaders, including Indian Premier Jawaharlal Nehru, reiterated opposition to any testing.**

**Soviet leaders apparently considered that technical gains from the resumption of testing and the psychological effect on the Berlin crisis balanced out any propaganda loss, diplomatic observers said. The Soviet news agency Tass said that the new weapons can be delivered to "any point on the globe" by "rockets like those Majors Gagarin and Titov rode to begin their space flights."**

# Nuclear Power Called Greatest Potential for U.S. Space Program

**Washington**—Nuclear devices ranging from the Nerva rocket engine to unexploited radioisotopes for auxiliary power hold the greatest promise for dramatic advances in the U. S. space program, government and industry witnesses told the Joint Atomic Energy Research and Development Subcommittee last week.

These witnesses testified at hearings called by Chairman Melvin Price (D.-Ill.), who said he wanted a progress report on the various nuclear programs to make sure they were moving as fast as possible. "Nuclear propulsion," Rep. Price said, "represents our best chance of leap-frogging the expanding lead of the Soviets." Testimony disclosed that:

- **National Aeronautics** and Space Administration is designing its chemically-powered moon rockets so that nuclear upper stages can be used if the technology advances faster than anticipated. James E. Webb, NASA administrator, said nuclear propulsion research is being pushed as fast as possible, and said NASA intends to select the contractor for the Nerva flight test "soon after the first of the year."
- **Both government and industry** see radioisotopes as relatively unexploited power sources for space missions, but neither wants to manufacture the materials on its own.

Subcommittee members asked witnesses repeatedly if there were any signs that Nerva could be launched before the 1966-67 target date. Atomic Energy Commission Chairman Glenn T. Seaborg said "the time scale could be shortened if we were successful with all tests planned." Kiwi B gaseous hydogen reactor test is scheduled for October and tests using liquid hydrogen for the fuel is expected early next year.

Seaborg, asked whether nuclear propulsion could be used for lunar flights said: "The clear mission [for Nerva] is for heavy payload flights of long distances beyond the moon and for the eventual exploration of further reaches of the solar system." He said the forthcoming Kiwi B tests would determine the feasibility of using nuclear engines being developed under Project Rover as upper stages for the manned mission to the moon.

Webb expressed similar views to the subcommittee on this point.

Krafft Ehricke, General Dynamics rocket executive, contended that "the only way to leap-frog Russia is utmost concentration on nuclear propulsion, not only in Rover, but also in the area of nuclear electric and ion-type vehicles."

AEC Commissioner Robert E. Wilson said the radioisotopes were proving to be useful for a variety of space applications. He said that during Fiscal 1962, AEC will continue its study of a curium 242-fueled generator to power NASA's Surveyor vehicle. Wilson decried the fact that AEC had been unsuccessful in inducing industry to go into the manufacture of radioisotopes. AEC estimates it would cost between $10 million and $12 million to build a plant to extract the isotopes from the waste stream of reactors at AEC's Hanford site. A major problem, Wilson said, is the uncertainty about the market for isotopes.

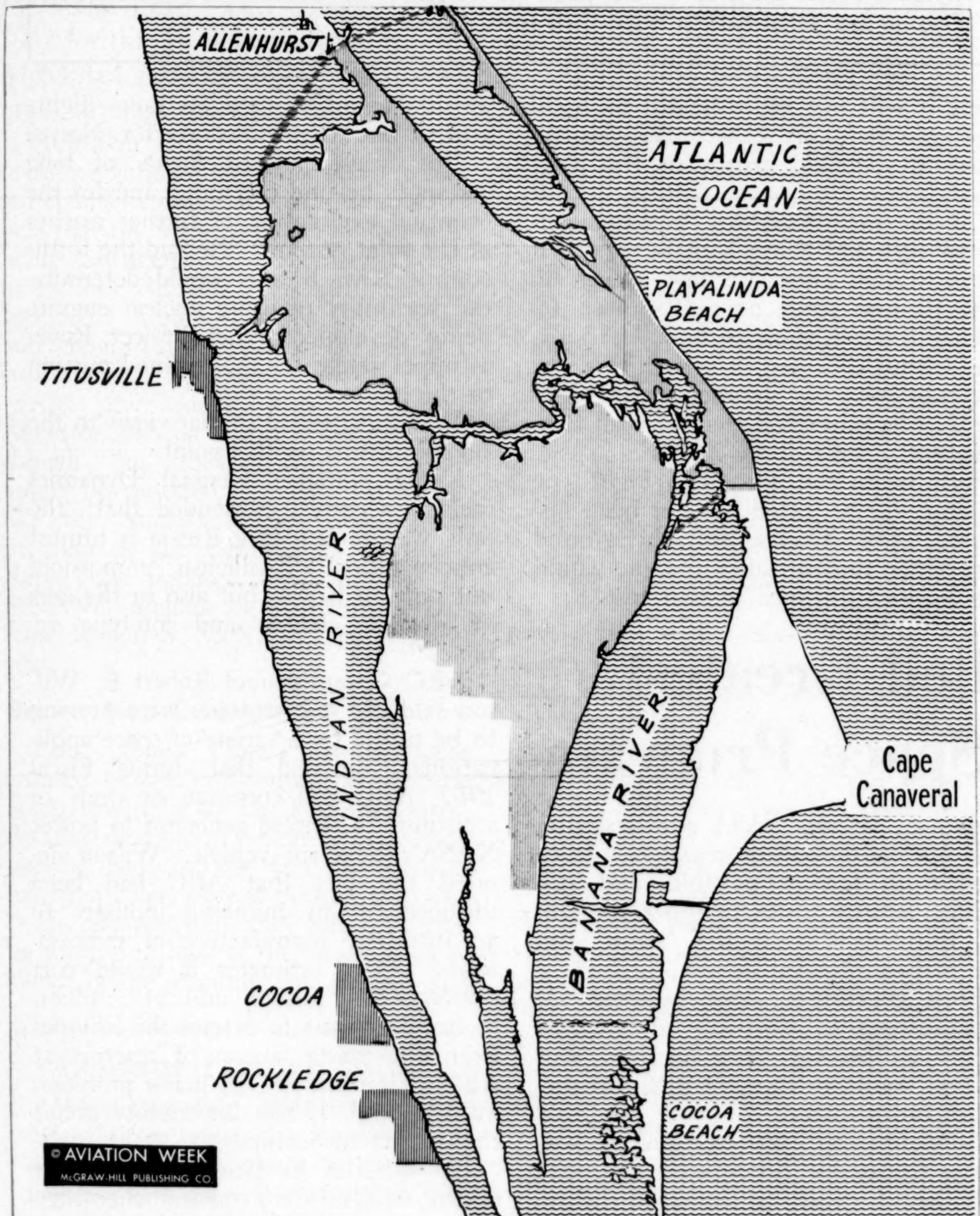
Dr. Charles E. Crompton, director of the Martin Co.'s nuclear chemistry department, said "the chief roadblock in the development of isotopic power is the impasse on fuel availability." He pointed to the variety of space uses for isotopes and said it would be in "the best interests of the AEC, the industry and the nation" for AEC to build a demonstration plant for extracting isotopes from the Hanford waste stream.

# Four Ranger Vehicles to Be Added To Unmanned Lunar Probe Effort

**Pasadena, Calif.**—Four Ranger spacecraft will be added to the National Aeronautics and Space Administration's unmanned lunar exploration program in an effort to obtain high-resolution television pictures of the moon's surface in support of the Apollo manned lunar program, Dr. Robert C. Seamans, Jr., associate administrator of NASA, said here last week.

Other anticipated changes in the NASA-Jet Propulsion Laboratory unmanned lunar and planetary exploration program were not discussed, however. These include the expected addition of several vehicles to the Surveyor soft-landed stationary lunar vehicle program, predicted here last month by Abraham Hyatt, director of program planning and evaluation for NASA.

In addition, there are indications that NASA and JPL, are considering cancellation of the Mariner-Venus deep space probes. The feeling is that Ranger spacecraft (beyond the nine now scheduled) could be modified to accomplish planetary exploration missions planned for Mariner sooner than the latter could.



**Planned Atlantic Missile Range Expansion**

**Area in color at top shows the 80,000-acre tract to be acquired by the National Aeronautics and Space Administration for expanding the Atlantic Missile Range to accommodate Nova and advanced Saturn launch vehicles (AW Aug. 28, p. 30). President has asked Congress for $60 million to buy the land. Cape Canaveral launch area, at lower right, consists of 15,000 acres and will handle boosters up to 1.5 million lb. thrust. New facility is for vehicles of 3-20 million lb. thrust category.**

The four additional Rangers announced here by Seamans will be designated RA-6 through RA-9, a series which might be expanded again if Mariner is dropped. Originally, JPL intended to fire two non-impacting Rangers, the second of which Dr. William H. Pickering, JPL director, said may take place in about a month. The program was to have been completed with the hard landing of three packages (RA-3 through RA-5) on the moon's surface.

Expected schedule for the remaining four shots of this original program cannot be accelerated.

Rangers RA-3, 4 and 5 will take TV pictures of the moon's surface before lunar impact. An instrumented capsule containing a seismometer, temperature measuring devices, and a radio will be rough landed on the moon's surface in each shot.

Rangers RA-6 through RA-9 will not carry the retrorockets to be used in the early lunar landings of RA-3, 4 and 5. Their high-resolution fine-grain TV cameras, and necessary telemetry for returning pictures to earth, will replace the instrument capsule used in RA-3 through RA-5. These spacecraft are expected to impact at 6,500 mph. rather than the 200-mph. impact velocity of the first several Ranger payloads.

The Astro Electronics Division of Radio Corp. of America in Princeton, N. J. will develop the television systems for Rangers RA-6, 7, 8 and 9.

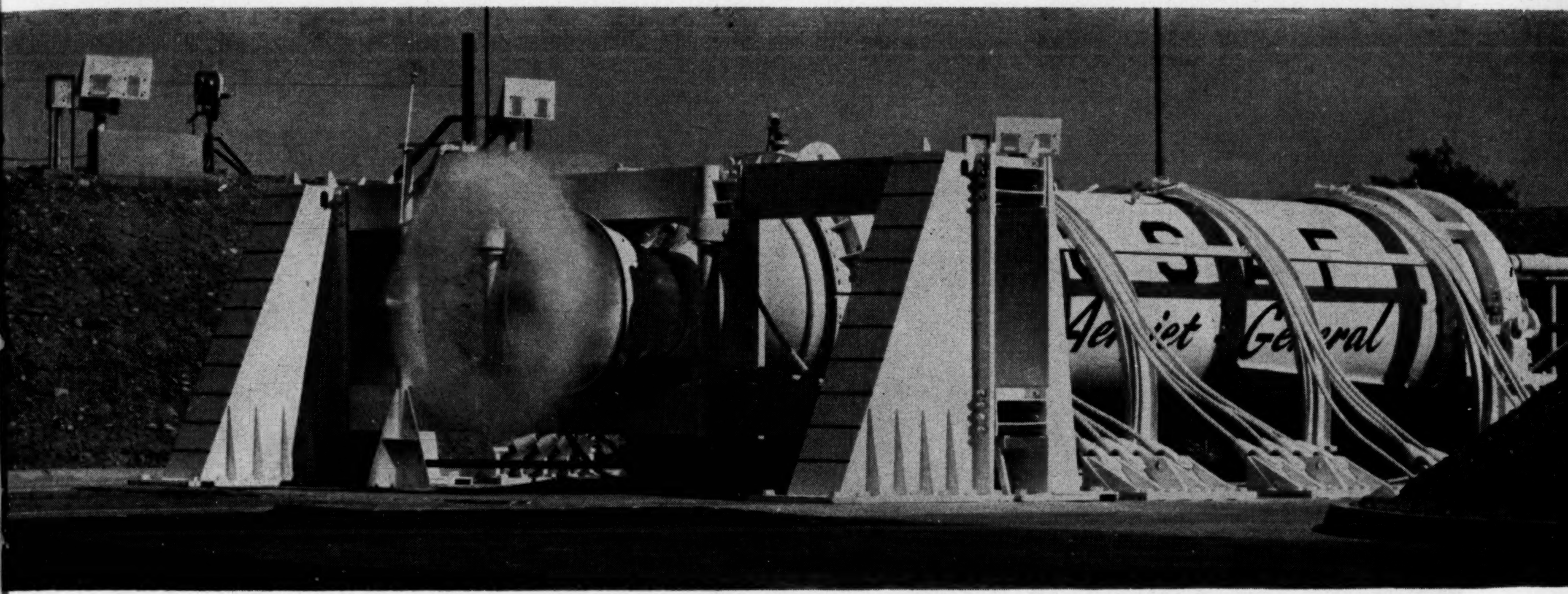
JPL officials indicated many of the intended missions of Ranger 1 (AW Aug. 28, p. 29) were achieved despite the failure of the spacecraft to achieve the desired trajectory. These missions included the test of elements in the spacecraft, gaining experience with the Lockheed Agena B and test of deep space instrumentation facilities.

All but one of the eight scientific instruments on Ranger provided data, although not necessarily the data originally desired. The solar corpuscular radiation analyzer and a Lyman-alpha telescope provided little scientific data. The magnetometer on the spacecraft was useless because it was saturated by the high magnetic fields encountered in the low earth orbit and because of its extreme temperature sensitivity.

A triple coincidence cosmic ray indicator, a cosmic ray ionization chamber, medium-range particle detectors and a micrometeorite experiment were all expected to yield useful scientific information.

A Vela Hotel experiment obtained good but insufficient data for desired statistical analysis.

Ranger 1 re-entered earth's atmosphere Aug. 29 and burned up after less than a week in orbit.



**Four-Segment, 500,000-lb.-Thrust Solid Motor Tested**

**Aerojet-General's solid motor, composed of four segments, 100-in. in diameter and totaling about 35 ft. in length and containing approximately 100 tons of polyurethane propellant, is shown at millisecond of ignition at recent Sacramento, Calif., firing. Full thrust of more than 500,000 lb. was generated for 67 sec. of the 87-sec. run. This was the fourth in a series of test firings in the large solid booster program and was preceded by the firing of a three-segment booster in June (AW June 12, p. 35).**

# Soviet Space Gains Threaten U.S. Security

Los Angeles—Soviet Union will use space to jeopardize U. S. security if the nation allows Russian military and civilian space technology to surpass ours, Dr. Robert C. Seamans, Jr., associate administrator of the National Aeronautics and Space Administration, said last week.

"U. S. mastery of space is essential insurance against finding ourselves with a technology inferior to that the Russians will develop . . . on the space frontier," he said.

Seamans told the Ballistic Missile and Aerospace Technology Symposium, held here by the Air Force and Aerospace Corp., there is a need to maintain a superiority over the Russians in space, since the competition involves "potential direct military conflicts" and a "deadly competition" for the support of the uncommitted people of the world.

Dramatic space achievements, he said, have become "today's symbol of tomorrow's scientific and technical supremacy."

Seamans said the growth of space research is comparable with that of nuclear physics after World War II. He said that space programs are cutting across the boundaries of established sciences, drawing together scientists of differing backgrounds and bringing new ideas and concepts into traditional disciplines.

Explaining NASA's decision to support manned space flight, Seamans said "integration of a human pilot into an onboard spacecraft system greatly improves reliability. The man can not only make in-flight tests but also inflight repairs. We have striking examples of this in missions of NASA's X-15 rocket airplane which has been flying to the fringes of space and has achieved a speed of 3,600 mph.

"In at least eight of 38 X-15 flights to date, flights would have failed without a pilot in the cockpit to correct malfunctions of equipment, instruments or powerplant. In at least as many other cases, if X-15 missions had been unmanned, we would have obtained no information because either instruments or telemetry failed. The X-15 pilot, however, was able to land with valuable flight information recorded by his own senses."

## Military Space Effort

**Washington—Chairman John Stennis (D.-Miss.) of the Senate Preparedness Investigating Subcommittee is pressing for a larger role for the military in the U. S. space program.**

**In a Senate speech, Sen. Stennis said "space technology will eventually become a dominant factor in determining our national military strength . . . . In times to come, whoever controls space controls the world." He said the separation of military and civilian space programs has "hampered the military from adequately and properly proceeding along in the space field as expeditiously as possible."**

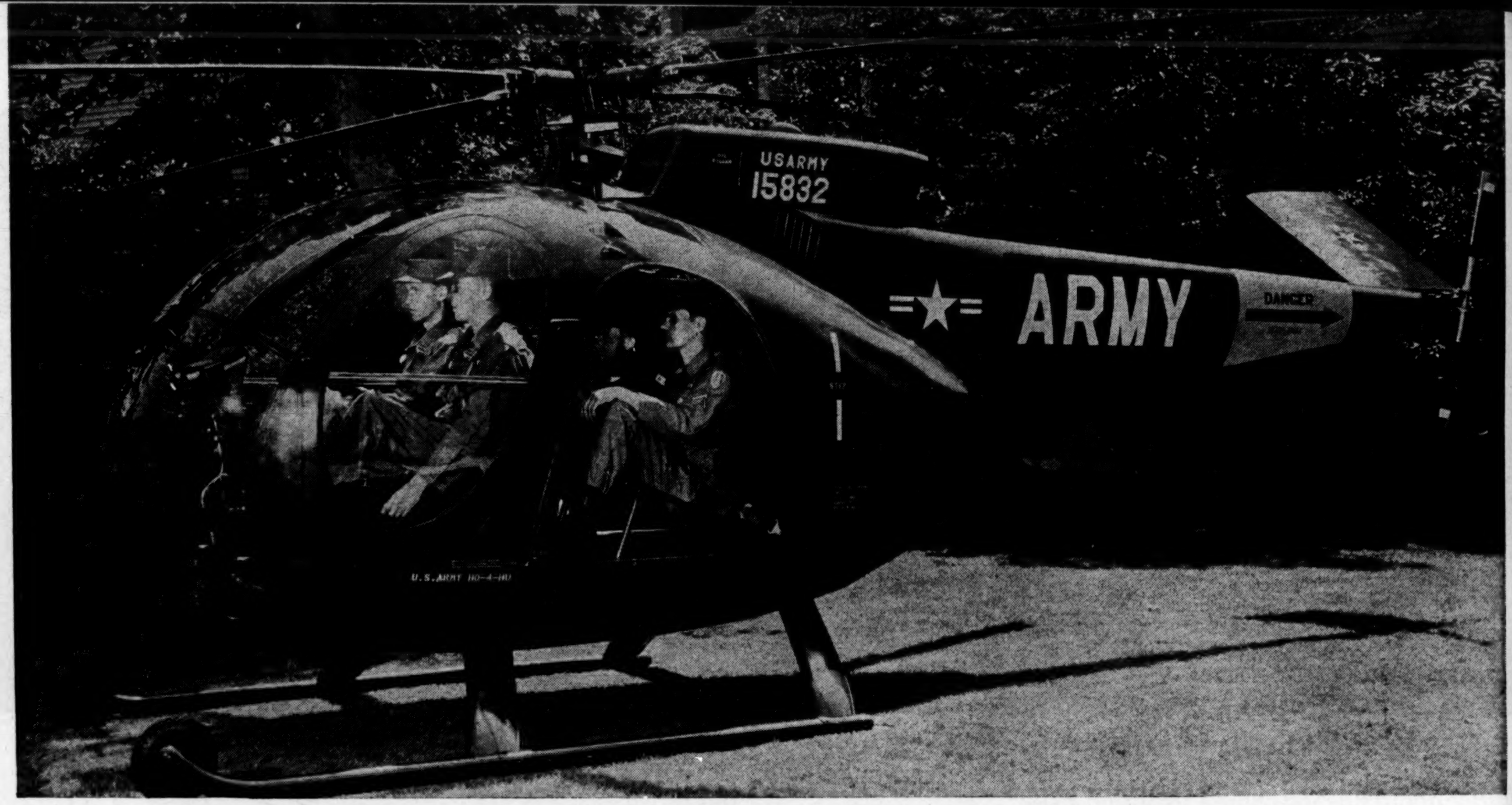
**Sen. Stennis, who is third-ranking member of the Senate Armed Services Committee, said the nation "has no choice but to develop manned, maneuverable space weapon systems, if for no other reason than to deny our potential enemies any military and political advantages that are likely to accrue to them from superiority in space." He compared the present status of the space program with that of the U. S. aircraft development at the beginning of World War I.**

In the keynote speech of the three-day symposium, Air Force Secretary Eugene M. Zuckert paid tribute to the nonprofit organizations that USAF hires to help manage its various programs and then warned that these organizations must not encroach on the responsibilities of the service or of its industrial contractors.

He said "in this connection, I commend to your attention the recent report issued by the House Committee on Government Operations, based upon an extensive study by its military operations subcommittee, under the direction of Chairman Chet Holifield (D. Calif.). It is an outstanding example of constructive legislative surveillance.

"Frankly, the committee gave our management concept a vote of confidence, but coupled with it words of warning, words we intend to heed. Within the next few months, we shall respond with ground rules specifically tailored to fit the situation of nonprofit corporations—an area which by its very newness is naturally the focus of attention."

Later, Zuckert acknowledged that the committee report had been widely interpreted as critical of the Air Force practice of management by nonprofit corporations but said the Air Force considers it a favorable report.



## Hughes Designs Model 369 for Army's LOH Competition

**Mockup shows configuration of Model 369 helicopter designed by Hughes Tool Co.'s Aircraft Division for Army's Light Observation Helicopter (LOH) competition (AW May 22, p. 29). Hiller and Bell were chosen to build the LOHs but Army recently made Hughes an equal partner in the program. Army designation for the four-place turbine-powered Hughes helicopter is HO-6. Hughes, Bell and Hiller are to build five models each initially of their respective helicopters for Army evaluation.**

# Army Committee Sets Guidelines For Helicopter Arming Programs

### By James D. Hendricks

**Burlington, Vt.**—Army development experts have recommended as a general guideline for helicopter armament programs that no more than one type of weapon be placed on a single helicopter at one time.

This recommendation was a highlight of a report filed Aug. 25 with the commanding general of Continental Army Command, Gen. Herbert B. Powell, by an ad hoc committee composed of senior officers from CONARC and the Army Aviation Center.

The committee chairman, Maj. Gen. Thomas F. Van Natta, CONARC deputy chief of staff for combat development, discussed major points of the report at the New England regional meeting of the American Helicopter Society here.

He said the committee disagreed generally with ideas which have been advanced by some military and industry agencies for "piling a lot of weapons on one helicopter" because of weight and cost limitations.

"Some of these 'Buck Rogers' ideas look very good until you start trying to load a lot of weapons on a utility helicopter like the HU-1 with a maximum gross weight limitation of 8,500 lb.," Gen. Van Natta remarked. "It's especially difficult when you are also trying to carry nine soldiers aboard."

In an earlier talk to the society, Brig. Gen. Clifton F. Von Kann, director of Army aviation, emphasized that loading bulky, extremely heavy weapons aboard utility helicopters can degrade their primary mission of troop transport.

Gen. Van Natta defined the four requirement areas for development of helicopter armament by mission:

- **Light weapons fire**, usually machine gun fire directed against isolated personnel targets in bursts which are effective for only about three seconds because of helicopter and/or target movement away from the target area.
- **Point fire**, in which rockets are directed against hardened targets such as bunkers or soft targets such as crew-served weapons lacking armament.
- **Area fire** to destroy assembled vehicles, command posts and similarly grouped targets as a supplemental or emergency tactic for artillery purposes. Gen. Van Natta stressed that helicopters will not "replace" artillery. He noted that they can be used for area fire, however, when urgency or mission nature dictates, such as a situation where regular artillery cannot be turned toward the target because of the target's location.
- **Air-to-air fire**, in which the same light weapons used for personnel attacks can be directed against aircraft of similar characteristics. He emphasized that helicopters will not be used in uneven matches with faster aircraft carrying more firepower in "dogfight" missions.

Earlier, Gen. Von Kann stated that even helicopter "dogfights" appear impractical, suggesting that other vehicles and weapons will be more effective in destroying armed enemy helicopters.

Enlarging upon the one helicopter—one weapon theory, Gen. Van Natta indicated that in some instances helicopters carrying area fire weapons (such as the SS-11 solid-propellant, wire-guided missile) might also carry light weapons if the latter were "light enough" to satisfy VTOL weight limitations.

He noted that helicopters "will not invade the field of general tactical air support" for land forces engagements. "Adequate tactical air support will be provided by one or both of the other services, under the effective control of the Army commander, or will be assigned as part of the Army mission."

Describing the ad hoc committee's prime purpose as an attempt to establish guidelines for single-authority control over Army requirements studies for helicopter armament, Gen. Van Natta pointed out that in the past military and industry agencies concerned with the program have lacked the guidance of a basic document.

The committee began work in early July and was briefed by civilian and military experts involved in helicopter armament problem areas and programs.

The committee report probably will be forwarded in the near future to the Army chief of staff's office in the Pentagon, an official at CONARC headquarters at Ft. Monroe, Va., said.

# Problems May Cut Polaris A3 Range Goal

**Washington**—Design goal of 2,500-naut.-mi. range for the Navy's projected Polaris A3 fleet ballistic missile is in jeopardy and may have to be abandoned temporarily unless technical difficulties plaguing development of the missile's first stage at Aerojet-General's Sacramento facility are overcome soon.

In recent weeks, the Navy has been concerned by the delay, brought about by the inability of stage materials to withstand the combination of high temperatures and high chamber pressures produced by the Aerojet engine. Navy may be forced to settle, at least in initial versions, for a shorter-range A3.

### ABL Gets Contract

Another complicating factor in the development picture is that—even though Aerojet held a sole-source research and development contract for the stage—Navy recently gave Hercules-Allegany Ballistic Laboratories (ABL) a special $6-million contract to conduct first-stage research and development and asked ABL to develop 10 first stage motors of Aerojet chamber configuration.

Previously, ABL had conducted some first-stage studies on its own, although it had been assumed in the industry that Aerojet would receive production contracts on the basis of its exclusive research and development contracts. The award to ABL, coupled with the difficulties at Aerojet, now make the likelihood of a production award to Aerojet considerably less certain.

ABL and Aerojet hold parallel research and development contracts on the A3 second stage, which is proceeding according to schedule at both laboratories.

### A2 Progress Good

Meanwhile, the 1,500-naut.-mi. range Polaris A2 is making good development progress despite difficulties caused by cracking in first-stage Jetevators, used for thrust vector control. Other problems with the A2 have been solved, permitting a slowing in the rate of development test firings. A2 production is scheduled for October, with deployment in a submarine expected later this year.

Despite present difficulties with the A3, Lockheed Missiles and Space Division, Navy's prime contractor for Polaris, is studying an entire family of advanced Polaris concepts, broadly identified as Polaris A4. If it were built, this missile actually would transcend the intermediate range ballistic missile designation, because it would be expected to achieve ranges in excess of 3,000 naut. mi. The Lockheed studies are not now funded, although Navy is fully aware of Lockheed's progress.

Lockheed apparently has hopes of interesting the Air Force in an A4 version because there is some doubt that the Navy would buy a new Polaris on the basis of increased range, or range alone. Strategically, the Navy says it does not need a longer-range missile, because the projected 2,500-naut.-mi. range of A3 would enable Polaris submarines to put their missiles on target from well out at sea.

The time of flight of a longer-range missile also would ease the enemy's detection problem.

In any event, a longer-range Polaris which could be accommodated by launch tubes of existing Polaris submarines appears unlikely unless some advance is made in the state of the art of propellants and/or materials. Modifying launch tubes to enable them to handle larger Polaris missiles is not feasible now because of technical problems and prohibitive cost.

Lockheed has asked Polaris contractors for contributions to the A4 studies. A4 probably would be a two-stage missile, like each of the three earlier Polaris versions. It would use a single nozzle for each of the two stages—contrasted with four nozzles on other Polaris types. Glass fiber chambers would be used.

### Temperature Problems

Navy had hoped that the 2,500-naut.-mi. range sought for A3 could be achieved by a Polaris using higher-temperature propellants in both stages. This range was predicated on the use of a propellant that utilized a nitroplasticizer and has a theoretical flame temperature of 6,600F and an operating temperature of 6,300F in the A3 first stage.

First stage materials used at Aerojet in its A3 development apparently have not been able to withstand this 6,300F temperature at 800- to 900-psi. chamber pressure. Goal for operating chamber pressure was expected to be as high as 1,000 psi. So far, there have been no completely successful firings of this stage.

Perhaps the closest the company has come to a successful firing was a recent test which lasted 40 sec. before the nozzles were destroyed.

Contrasted with propellants ABL probably will employ for the first stage, Aerojet propellants are more stable, but more corrosive. ABL's propellant delivers greater specific impulses, however. The Aerojet propellant tends to attack nozzle material, whereas ABL's does not. This may enable ABL to use less expensive, more readily available nozzle materials, with lower stress requirements.

Aerojet is considering settling for cooler propellant temperatures—possibly 5,800F or 5,900F—which are estimated to shorten Polaris A3 range to 2,300-naut. mi. Comparable burning temperature for the 1,200-naut.-mi. A1 is about 4,900F.

Navy may have to settle for 2,300 naut.-mi. range unless ABL can improve performance characteristics.

### Management Shifted

In an effort to correct the problems it has encountered with the A3 first stage, Aerojet has shuffled management of the program. Manager of the second-stage project, which has been going ahead on schedule, recently was put in charge of the lagging first-stage development. Manager of the first stage was then put in charge of the second stage.

Problems with the second stage have not been as severe as those with the first stage. The combination of temperature and chamber pressures are much lower in the second stage. Propellant temperature of the second stage roughly is 100F less than that of the first stage, and chamber pressure is only about 325 psi.

The longer range for Polaris A3 cannot be obtained by increasing the size of the missile because of missile diameter and length restrictions imposed by the size of Polaris-carrying submarine launch tubes. There had been some allowance for increase in missile length over that of the initial 1,200-naut.-mi. range Polaris, but this tolerance cushion has already been taken up by increasing the length of A2 by 30 in. This greater length helps A2 toward its 1,500-naut.-mi. range goal.

### New A3 Developments

New developments for the Polaris A3 missile will include:

- **Thrust vector control** achieved by four movable nozzles on the first stage. Jetevators are being used on the first stage of A2 and A1.
- **Second stage** will have four fixed nozzles and will utilize fluid injection for thrust vector control.
- **Glass filament-wound chambers** will be used for first- and second-stage rocket motors.
- **Mass ratios** for both stages are about equal to those of A2.
- **Expected standard** specific impulses for first stage is 244 or 245, and 244 for the second stage.

# President Warned on AT&T Role In Communications Satellite System

**Washington**—Increasing concern in Congress that American Telephone & Telegraph Co. may dominate a space communications system was indicated last week by two letters of warning to the President and the announcement of new public hearings on the ownership of such a system.

Chairman Russell Long (D.-La.) requested Federal Communications Commission Chairman Newton N. Minow and FCC Commissioner T. A. M. Craven to appear before the Senate Small Business Monopoly Subcommittee Oct. 17 "to describe, analyze and evaluate the recommendations" on ownership made by an FCC-appointed committee of 10 international common carriers. Congress, other government agencies and the general public will then attempt to determine "whether they are in the public interest and not in the interest of maintaining or extending the power of existing monopolies."

Sen. Long also asked FCC to furnish the subcommittee with complete documentation on the recommendations by Oct. 16—the Monday following the Friday, Oct. 13, deadline for their submission to FCC—so that they can be studied in preparation for the subcommittee hearings.

At the same time, Sen. Long declared in a letter to the President that it would be "foolhardy" to grant private ownership of a communications satellite system "to a set of so-called international common carriers" before the system has been developed to a practicable stage.

Six of the 10 members of the committee have indicated no interest in ownership of a space system. This leaves four active members—AT&T, International Telephone and Telegraph Co., Radio Corp. of America and Western Union Telegraph Co.

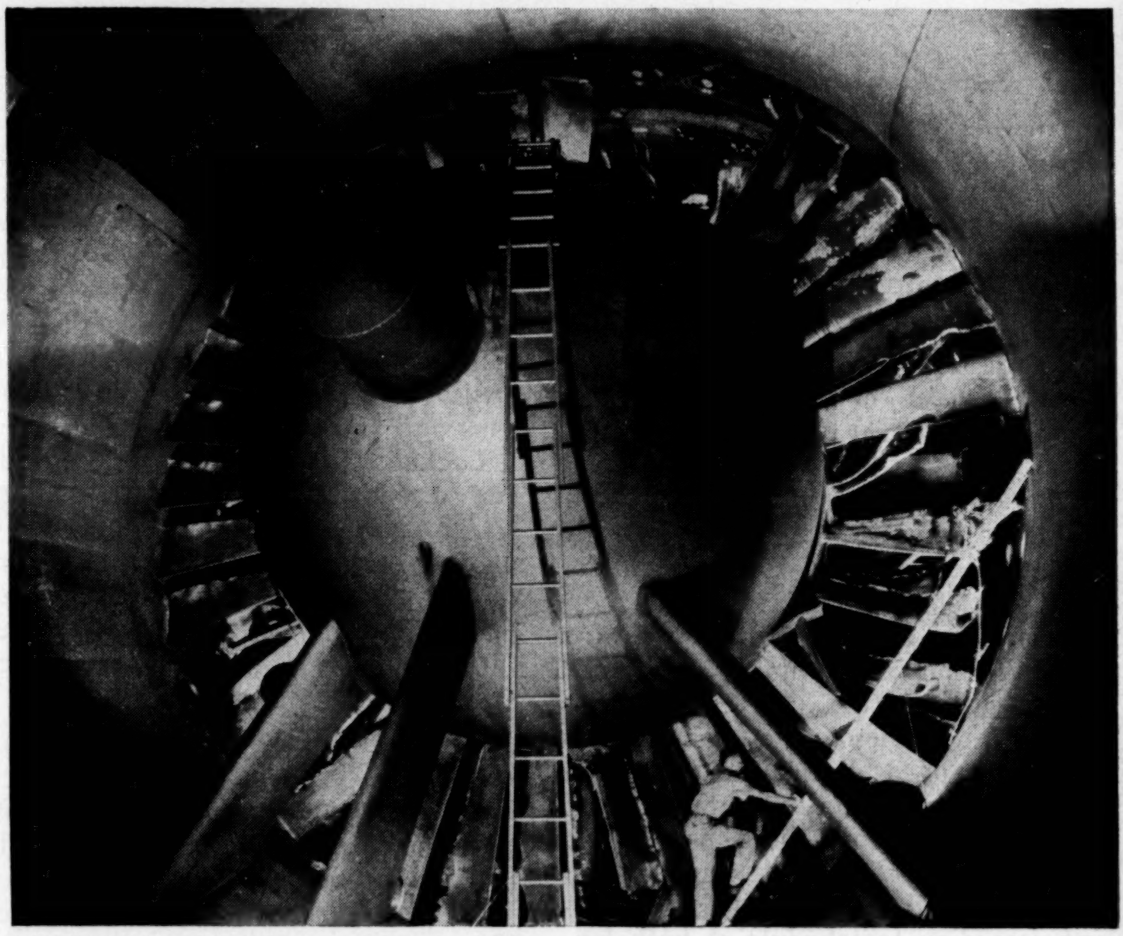
In another letter to the President, 35 other members of Congress said they are "deeply concerned" over FCC actions in establishing the committee, "which clearly contemplate limiting ownership to a specified group of so-called 'international carriers' which does not even include all these carriers."

The letter, drafted under the leadership of Rep. Emanuel Celler (D.-N. Y.), chairman of House Judiciary Committee, continued: "This would mean only four concerns would participate in the system's ownership. . . . More important, it would mean that one of these four companies, AT&T, would have a dominant and very probably a monopoly position in ownership of the space communications system. In effect, AT&T would be the chosen instrument of the United States government to own and control civilian space communications."

The Celler group called on the President to postpone any actions that might affect ownership of the system until it is "fully operational." The congressmen urged "extensive research, experimentation and development" under government contract in the interim, and said all parties interested in ownership should be consulted and all facets of international cooperation and ownership "thoroughly explored."

To be consistent with anti-trust laws, the group said, any system of private ownership must be open to all interested aerospace manufacturers and all domestic, as well as international, communications carriers.

The group said that careful thought should be given to whether and how the eight stringent tests laid down by the President for private ownership of a space communications system (AW July 31, p. 25), can be met. "But the rapid development of this new gift of science should move ahead unhindered by a premature struggle over its fruits," the congressmen said.



**EXTENSIVE DAMAGE** done by failure of compressor of Propulsion Wind Tunnel, AEDC, may cost $2 million to repair and keep the tunnel out of action from one to two years.

# Compressor in Wind Tunnel Fails

**Tullahoma, Tenn.**—Progressive metal fatigue is believed to have caused failure of the three-stage transonic compressor during a test run in the Propulsion Wind Tunnel of Air Force Systems Command's Arnold Engineering Development Center here.

The compressor failed while running at about one-third power, causing extensive damage, tearing or loss of the forged steel blades.

Engineers from the Air Force and from Aro, Inc., operators of the AEDC facility, believe that progressive metal fatigue in the compressor disks caused separation at a point directly below one or more of the blade seats.

Neither the motors, which also drive the supersonic circuit compressor, nor the supersonic compressor itself were damaged.

Tests scheduled for the transonic circuit have been rescheduled at other facilities or canceled.

Currently, there is no indication of how long the circuit will be out of action, or how much it will cost to repair. Estimates of repairing the compressor and operating it again show that much depends on what can be salvaged, and on the engineering work in design and fabrication of new blades. One estimate, however, is $2-million cost and one or two years time.

One other factor affecting the length of shutdown and cost of repairs is that new blades may be made of laminated glass fiber instead of steel.

# Navy Large Seaplane Interest Increases

By Russell Hawkes

**San Diego, Calif.**—An 80,000-lb.-class seaplane capable of staying at sea for days at a time was described as the answer to Navy's ASW aircraft requirement in the period after 1970 by L. B. Richardson, consultant to General Dynamics Corp., in a speech at the annual Naval Aviation Meeting of the Institute of the Aerospace Sciences.

Later, Vice Adm. Robert B. Pirie, deputy chief of naval operations (air), said that the Navy is about to let early phase contracts for the development of a new anti-submarine seaplane in this weight class. Pirie said the Navy tactical philosophy has been to divide its long-range patrol aircraft orders between land- and sea-based designs on a 1-to-1 ratio.

The present ratio is more like 2-to-1 in favor of land-based patrol planes and no new seaplane is in sight to replace the aging Martin P5M anti-submarine patrol planes.

Richardson called the development of a true seaplane, capable of remaining at sea and being supplied by conventional submarines, an important objective. He pointed out that Soviet pressures and cold war successes could see U. S. foreign bases replaced by Soviet submarine pens. The effect would be to reduce U. S. anti-submarine capabilities in the face of an increased submarine threat.

Given proper logistic support, a seaplane force could operate against enemy submarines close to their ports. Seaplanes also have tactical advantages that allow them to cooperate more effectively with other anti-submarine forces. The ability to land in the open sea would enable such an aircraft to use more effective sonar than the Julie-Jezebel buoy systems now in service. The long-range, deep-depth, relatively light sonars for the seaplane could be used in combinations with the already developed air-drop sonobuoys and explosive echo ranging equipment for classification and kill operations. The effect would be to give the ASW seaplane a high search rate at a moderate cost.

Richardson said the new design would have the flexibility usually demanded of patrol aircraft and would be able to take part in ASW convoy, task force, barrier, reconnaissance or mine sowing and mine countermeasure operations.

He described the airplane proposed by General Dynamics as a STOL (short takeoff and landing) design which could take off within three or four hull lengths in state 4 seas. Liftoff of the loaded airplane would be at a speed between 35 and 45 kt. At a maximum gross weight of 80,000 lb. to 90,000 lb., it would carry a military payload of 11,000 lb. Operating at altitudes under 5,000 ft., the proposed ASW seaplane could exceed a combat radius of 1,000 naut. mi. plus 5-hr. loiter on station. It would cruise at 200 or 250 kt. and would be capable of a 2,600-naut.-mi. dash at a top speed of 350 kt. By penalizing the range capability it would be possible to give such an airplane vertical takeoff capability.

## Key of Concept

Key part of the concept is the airplane's ability to remain at sea and receive maintenance and other logistic support from mobile fleet elements. Richardson suggested standard, petroleum-fueled submarines. To remain safely afloat in heavy weather, he suggested that vertical spar buoy floats be used. He did not specify how the installation would be made, but it would be able to eliminate or greatly reduce all rolling and pitching. Heavy consideration would have to be given to human factors in the engineering of the equipment and the design of the interior so that crews could remain effective on missions that would include many hours of flight and days afloat on surface stations.

Richardson predicted that all the technological advances needed are known to provide this capability and eliminate the existing problems of seaplanes. He said, "lessened maintenance requirements can be obtained through improved engine design, spray depressors, semi-automatic checkout equipment and new modular electronic system maintenance techniques."

At the same session of the IAS-Navy meeting, Leonard N. Liebermann of the Scripps Institute of Oceanography said that research is proceeding toward methods of making submarine wakes visible at the surface of the sea. He said that theory indicates the surface of the sea should be disturbed by the passage of a submarine and with proper equipment, ASW aircraft may be able to "see submarine wakes. Such wakes are subtle and easily masked by wind waves.

## Boost-Glide Fighter

Boost-glide vehicle armed and equipped to serve as a carrier-based air superiority fighter was briefly mentioned by John F. Aldridge, vice president-advanced product planning, McDonnell Aircraft Corp. The boost-glide fighter is probably smaller and designed for shorter ranges than Dyna-Soar, but Aldridge would not be drawn out in specific questioning. One version of the company-funded project would be launched vertically into an initial ballistic trajectory. It could give vessels other than aircraft carriers the ability to launch air superiority fighters. Industry officials and Navy officers at the five-day San Diego meeting informally discussed the possibility of using the boost-glide fighter to destroy enemy reconnaissance satellites and preserve the security of fleet movements in the open sea. Aldridge said such a manned weapon system would be able to "operate independent of a central battle control," if necessary.

He said quick reaction is being emphasized in the program. The boost-glide fighter would be able to loiter on station and return to the aircraft carrier. No mention was made of the possibility of an orbital return to carrier.

# Explorer Satellite Falls After Two Days

**Washington**—Explorer XIII satellite provided 73,980 bits of data on the characteristics and potential hazards of micrometeoroids during its two-day lifetime.

Launched Aug. 25 as the payload of the sixth Scout development flight from Wallops Island, Va., the satellite appeared at first to have gone into its planned orbit, but the orbit rapidly decayed until the final track put the perigee at between 70-75 mi.

Explorer XIII weighed 190 lb. and contained five micrometeoroid detectors wrapped around the Scout's fourth-stage Altair rocket. The detectors were designed by National Aeronautics and Space Administration's Langley and Lewis Research Centers, and Goddard Space Flight Center.

Analysis is being made to determine why the package was not injected into the planned path, which would have had a 610-mi. apogee and 280-mi. perigee. It was initially tracked on a 606-174-mi. orbit, and transmitted more than 100 tracking messages to 11 ground stations. Total telemetry transmission time was 13 min., each minute providing 5,760 bits of data.

Scout development program has included two ballistic flights and four orbital attempts. The vehicle has successfully orbited Explorers IX and XIII in first uses of an all-solid propellant rocket as a satellite launcher.

Scout 7 will be used to launch the P-21 electron density probe, and if this experiment is successful, Scout 8 will be a re-entry test. The P-21 attempt will be repeated if it is not successful, with Scouts 8 and 9 designated as backups. Scout 10 will launch the British electron density satellite.

# NASA Will Use Scout for Testing Of 10 Electric Propulsion Payloads

**Washington**—Scout, four-stage, solid propellant launch vehicle, will be used as a flying testbed for 10 payloads containing electric propulsion systems in a program to start in 13 months at Wallops Island, Va.

The program is called SERT by the National Aeronautics and Space Administration, the initials standing for Space Electric Rocket Test. Only two payloads have been specifically marked for the program, but NASA plans to flight test any engine that looks feasible. Early flights will be made over a ballistic trajectory, but this may mature into an orbital program.

USAF Capt. Richard J. Hayes, temporarily assigned to NASA, has been named electric propulsion flight test manager. He told Aviation Week the present plan is to launch a SERT capsule every three months.

Radio Corp. of America's Astro-Electronics Division has been awarded an 18-month contract for $993,559 to build SERT capsules, package the engines and install flight test telemetry and instrumentation (AW July 24, p. 39).

First payload will contain two engines, one a cesium ion system built by Hughes Aircraft Corp. and the other a mercury ion engine developed by NASA's Lewis Research Center. Payload will weigh 200 lb. and will be evaluated on the basis of the ability of the engines to counteract and then to increase the spin rate of the spin-stabilized fourth stage.

If the first test is successful, the second payload will contain an arc jet made by Plasmadyne under NASA contract, and an ion engine built by Electro-Optical Systems under contract to USAF Systems Command's Aeronautical Systems Division. If SERT I is unsuccessful, it will be repeated.

Capt. Hayes said the program is a cooperative one between NASA, USAF and industry, since many funded and unfunded engines of promise are being developed independently.

The ballistic SERT flight profile will take the package to a 4,100-mi. altitude and 4,000-mi. range. This trajectory will keep the capsule above 200 mi. for 60 min.

Engines will be powered by two-volt silver zinc batteries having 34 cells in two packs. Batteries weigh 60 lb. These flights will evaluate engines and components to be flown with the Snap 8 space nuclear auxiliary power generator in a program expected to begin in 1965. The Snap 8 electric propulsion payload will be launched by a Centaur vehicle, under present plans.

The electric engines will be folded under the nose fairing in the launch configuration, and will drop to a horizontal position after the fairing is jettisoned. Scout fourth stage X-248 is stabilized by spinning to 160 rpm., and when the fairing has been jettisoned, drag of the engine is expected to slow the spin rate to 100 rpm.

Evaluation of engine performance will be made by starting one engine against the spin. Running 20 min. at .002 lb. thrust, the engine is expected to slow the spin rate to 70 rpm.

The first engine then will be shut down and the second started, this time in phase with the spin. In a 20-min. cycle, the spin is expected to be increased to more than 100 rpm.

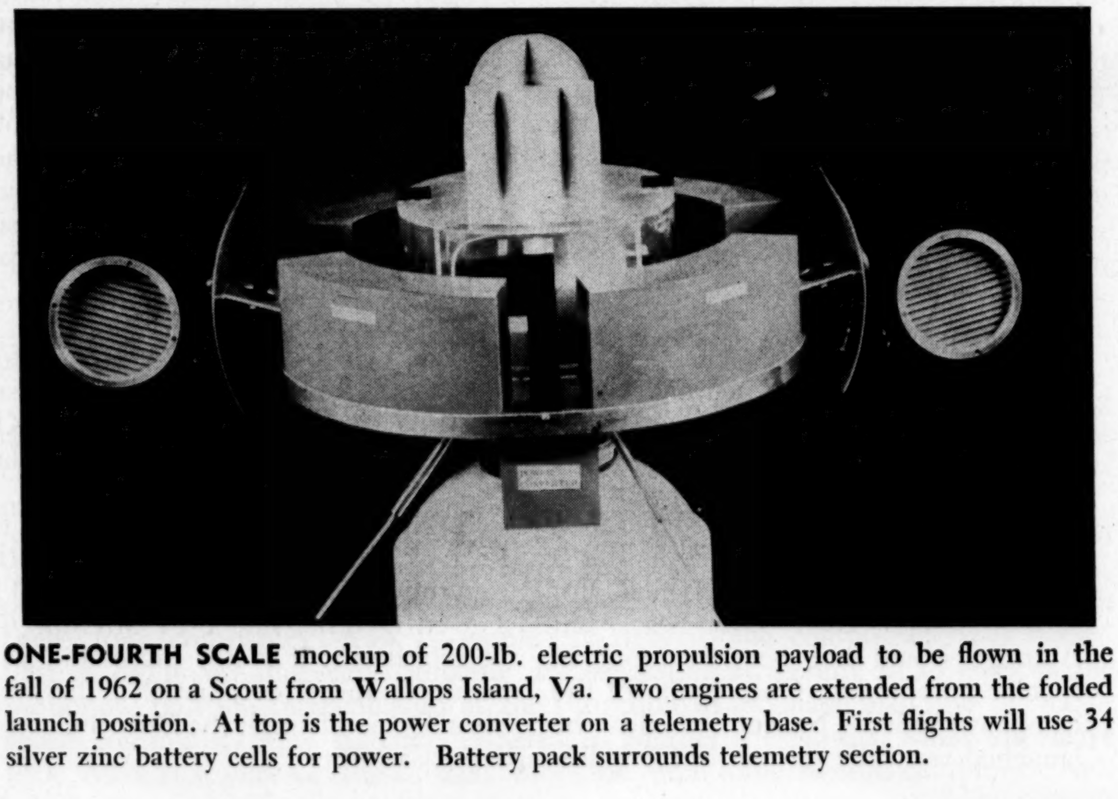
Flight data will be measured on the ground by counting the number of revolutions made by the antennas, and in the capsule by counting the times the sun sensor crosses the sun.

Capt. Hayes said each engine will be rated at between 500 watts and one kilowatt, and the engines can be switched on and off by ground command.

Snap 8 engines are expected to be rated at about three kilowatts.

NASA expects to let three study contracts this fall for conceptual design studies of the Snap 8 system, and to go into the hardware phase for electric propulsion engines for this system with Fiscal 1963 money.

The present plan is to fly one Snap-powered electric engine payload in 1965 and a second a year later. The 2,000-lb. payload will be launched into a low earth orbit and will have an expected lifetime of a year.



**ONE-FOURTH SCALE mockup of 200-lb. electric propulsion payload to be flown in the fall of 1962 on a Scout from Wallops Island, Va. Two engines are extended from the folded launch position. At top is the power converter on a telemetry base. First flights will use 34 silver zinc battery cells for power. Battery pack surrounds telemetry section.**

# Space Data Secrecy Defended by Russia

**Moscow**—Soviet Cosmonaut Gherman Titov continued to discuss his space flight in Pravda, the Communist Party newspaper, last week but Pravda said in a separate full-page account that it is too risky to reveal much about space programs to a "corrupt capitalistic society."

Much data on space is kept secret, Pravda said, because such a capitalistic society "by its very nature" is able to turn peaceful achievements into means of destruction.

Maj. Titov's account shed no new light on technical details, but contained popularized impressions of his 25 hr. 18 min. flight. For the first time, he said he was not restrained in his life support couch for all of the flight.

Soviet scientists continue to speculate about more advanced manned space flights. Norair Sisakyan, a leading biologist, said many alternatives have been discussed for surviving solar flares, including induced lethargy. But he questioned why man should be sent on a space trip if he were not allowed to remain alert.

Maj. Titov's diet was soup puree, liver pate and currant juice, all in plastic tubes. He also ate small pieces of bread and vitamin pills and drank water.

Roman Beyevsky, an expert in space medicine, said Titov's pulse averaged 88 beats per minute during the flight, and dropped to a rate of 53-67 when he was sleeping. He said Maj. Titov's flight proves prolonged weightlessness has no effect on man's work capacity, body functions or nervous system.

# Use of Escorts on Berlin Flights Planned

By Larry Booda

**Washington**—Fighter escort for aircraft flying the air corridors to West Berlin was being planned last week in case Soviet or East German forces attempt to interfere with these flights.

Move to protect air access to the divided city came after the U. S. and Britain, in parallel notes, rejected as false a Soviet charge that they were abusing the use of the three corridors. The notes reiterated a "solemn warning" against interference with the flights.

In the event that civilian pilots flying the routes should refuse to stay on the job under military emergency conditions, plans are to use military transport aircraft to maintain the air communications lines. Such a move would create an operation similar to the Berlin airlift of 1948-49.

Other U. S. plans to impress the Soviets with its determination to protect Western rights in Berlin were reported solidified last week.

These plans, however, must be amalgamated with those of the other Western allies, who had not been able to come to agreement among themselves. A meeting of Western foreign ministers will be held Sept. 14 to resolve difficulties, President Kennedy said.

The President also announced that he is sending retired Army Gen. Lucius D. Clay to Berlin as his personal representative.

Buildup of U. S. forces and materiel was matched in part by the Soviet Union as it halted demobilization of its armed services. It also announced that it would resume nuclear weapons testing.

Secretary of Defense Robert S. McNamara, with the President's approval, called to active duty 311 selected units from the military reserves. Approximately 76,500 personnel are affected—23,600 from the Air Force, 6,400 from the Navy and 46,500 from the Army. All the units will report for duty between Sept. 25 and mid-October.

## Procurement Accelerated

Action to accelerate procurement of already-on-order military materiel was being taken. The Army, for example, placed an order to the Remington Arms Co., Inc. for $5,974,291 worth of ammunition. Increased Army helicopter orders for the Hiller H-23, the Bell H-13 and the Sikorsky H-34 were being prepared. No decision had been reached last week as to whether both the H-13 and H-23 light observation types would be ordered. The number being considered is 200.

Additional orders for the Boeing C-135 turbojet transport and the Lockheed turboprop C-130 are to be placed shortly, with the emphasis being placed on the C-135. Both production lines can be accelerated by increasing shifts and procurement of components.

In the tactical deployment of forces, the European theater will remain about the same, but in the Western Pacific there has been heavy emphasis on the Southeast Asia area. Units and materiel have been shifted from Okinawa to The Philippines. Three aircraft carriers are continuously deployed in the area.

The Marine Corps expects to reach its 190,000 authorized strength by the end of the year. The increase will be accomplished through voluntary enlistments and voluntary active duty for enlisted reservists.

Air Force has raised its enlistment objective substantially above the 97,000 originally scheduled for this year. The number of graduates from Officer Candidate School will be raised 200 to a total of 700, and graduates from Officer Training School will be raised 600 for a total of 1,900.

## Units Recalled, Retained

Retention for periods up to one year has been offered officers with skills in communications, electronics, missiles, maintenance and civil engineering, medicine, meteorology and armament. Retention for airmen has been offered to those with skills in air traffic control and warning, communications, radar, missile systems, armament, nuclear weapons, training devices and maintenance of aircraft accessories, aircraft and weapons.

Comprising the 52 Air National Guard and Air Force Reserve units that were recalled were tactical fighter wings and squadrons, air transport wings and squadrons, tactical control squadrons, troop carrier squadrons, air transport squadrons, tactical reconnaissance squadrons, and aircraft control and warning squadrons and flights.

Navy will issue orders for involuntary retention of Naval Reserve personnel for periods of 6 to 12 mo. for officers and enlisted men scheduled for voluntary separation in September, and for about 90% of officers and 30% of enlisted men in later months of the fiscal year. Line officers and aviators of the rank of lieutenant commander and below will form the bulk of the officers retained. About one third of the 63 enlisted ratings will not be affected.

Of the reserve units recalled, there are 18 air squadrons and the crews of 40 destroyers. The aviation units consist of five land-based patrol squadrons flying Lockheed P2V Neptune aircraft and 13 anti-submarine warfare squadrons flying carrier-based Grumman S2F tracker aircraft.

Voluntary extensions have been offered to enlisted men in critical ratings such as aviation electronics technician, aviation ordnanceman, aviation fire control technician, aviation structural mechanic, parachute rigger and aviation storekeeper.

Army reserve units recalled number 197, of which there was one helicopter unit and three aircraft service type units.

Defense authorizations for increases in civilian hiring amounting to 10,000 have been spread among all the services. A substantial portion has been committed to Washington area activities but most have been allocated to maintenance, overhaul and supply activities across the country to take care of the increased workload.

# Special Group Studies Large Space Vehicles

**Washington**—Large Launch Vehicle Planning Group has been in session since Aug. 1 to study the policy, management structure and requirements of launch vehicles beyond the size of Saturn.

The group (AW July 31, p. 33), headed by Dr. Nicholas E. Golovin, is meeting at a National Aeronautics and Space Administration headquarters building here.

Aerospace Corp. is defining requirements for the solid propellant Nova vehicle under a NASA contract (AW Aug. 14, p. 29), and will provide technical direction for the USAF Nova solid fuel development program.

Members are Dr. Lawrence Kavanau, special assistant for space in the Defense research and engineering office, who is Golovin's deputy; Capt. Levering Smith of Navy's Bureau of Weapons; Col. Otto Glasser, Col. M. A. Cristadora, Jr. and Lt. Col. David Carter, USAF Systems Command; Milton Rosen and Eldon Hall of NASA headquarters; Frank Williams and Wilson Schramm of NASA's Marshall Space Flight Center; H. J. Weigand, scientific adviser to the USAF deputy chief of staff for systems and logistics, and Edward Barlow and Warren Amster of Aerospace Corp.

Dr. Golovin recently returned to NASA as technical assistant to the associate administrator, Dr. Robert C. Seamans, Jr. He was NASA deputy assistant administrator until early last year, when he joined the Rabinow Engineering Co. consulting firm.

# Low-Altitude Speed Record Set By Navy-McDonnell F4H Phantom

**Washington**—Low-altitude three kilometer (1.8 mi.) straightaway speed record of 902.769 mph. was set last week by a Navy-McDonnell F4H Phantom II fighter aircraft at the White Sands Missile Range, N. M.

Procedure rules for the run limited the altitude above the ground to 100 meters, or 328 ft., and required that two runs in each direction be made in less than 30 min.

The pilot, Lt. Hunt Hardisty, and the radar intercept officer, Lt. Earl H. De Esch made their runs in the two-place, twin-engine aircraft shortly after 6 a. m. MST Aug. 28 to avoid air turbulence which would appear with the heat of the day. Both are assigned to Fighter Sqdn. 101, Detachment A, Naval Air Station, Oceana, Va.

The area where the runs were made is flat and level and is 4,700 ft. above sea level. It lies in a bowl at the extreme northwest corner of the missile range in south central New Mexico, near the Trinity site where the first atomic bomb was detonated.

Marking the course, which runs north-northeast and south-southwest, is a black band about 10 ft. wide. An entry and exit gate to the course lies 1,000 meters from each end. Timing traps consisting of Mitchell cameras, theodolites and Askania cameras mark each end of the course proper. The terrain is light colored sand dotted with desert shrubs.

In making a run the aircraft flies out to the right of the course line for 18 to 20 mi. and makes a gentle left turn until it is lined up with the course line. At this point the afterburners are lighted and acceleration to run speed is made. Part of the northeast approach is through a gap in the mountains.

The aircraft must be below the 100-meter limit when it passes the entry gate. Altitude is checked from four Army L-9's carrying official observers and specialized gear.

To mark the course, which cannot be seen by the pilot at such low altitudes from the approach distances, three Army H-13 helicopters dropped smoke generators.

Controller for the course is an Air Force officer. Altitude control of the aircraft is by "seaman's eye," since the standard barometric altimeter is subject to rapid variations in pressure over the course. In one practice run, it was noted that barometric pressure shifted 0.3 in. of mercury over a distance of 10 mi., accounting for an error of 700 ft. A radar altimeter is not standard equipment in the F4H.

Lt. Hardisty said the greatest problem in flying "on the deck" supersonically is that navigation by landmarks at such speeds is almost impossible. Map reading would be dangerous because the pilot's full time and attention is needed to maintain a level flight path. The slightest upward deviation zooms the aircraft; a mistake the other way would be fatal.

The National Aeronautic Assn. will submit the record to the Federation Aeronautique Internationale in Paris for certification. The best previous record for the 3-km. course was 752.94 mph. set by Navy Lt. Cdr. James B. Verdin in a Douglas XF4D on Oct. 3, 1953.

Lt. Hardisty was awarded the Distinguished Flying Cross and Lt. De Esch the Air Medal for setting the record.

## Women's Speed Record

**Washington—Jacqueline Cochran, president of the National Aeronautic Assn., has claimed a new women's world jet speed record of 842.6 mph. for the 15 km. straightaway course.**

**Miss Cochran made the two passes over the course at Edwards AFB, Calif., Aug. 24, at 36,000-ft. altitude in a Northrop T-38 trainer. The old record of 715.197 mph. was held by French Aviatrix Jacqueline Auriol on May 31, 1955, in a Dassault Mystere IV fighter.**

# Vought, Hiller, Ryan Recommended For Tri-Service VTOL Transport

**Los Angeles**—Selection of the team of Vought Aircraft Corp., Hiller Aircraft Corp. and Ryan Aeronautical Co. to develop the tri-service VTOL transport was recommended to Defense Department last week by the Military Selection Board after agreement between USAF and Army on a compromise specification and resignation of Navy from active participation in the program.

Recommendation still could be upset if Defense Department insists that a compromise satisfactory to all three services be found.

### Delayed Decision

Decision was delayed by controversy between Army and Navy members of the selection panel over specifications and technical approaches. The most important technical issue was the choice of a basic VTOL concept. Army favored the tilt-wing turboprop concept that was eventually chosen and Navy favored a rotatable ducted-fan concept. Early in the discussions, USAF sided with the Navy on this question but switched its support to the Army position shortly before the final selection was made.

The program will be managed by USAF. Navy will pay its share of the program costs despite the fact that it will take no active part in the development of the airplane. Each of the three services will contribute $7 million for FY 1961 and FY 1962. Total cost of research, engineering and fabrication in the program is estimated at about $70 million.

The announcement released by Air Force Secretary Eugene Zuckert at the USAF-Aerospace Corp. Ballistic Missile and Aerospace Technology symposium in Los Angeles said, "The decision to proceed under Air Force management came after evaluations of the program indicated meeting the Navy's carrier compatibility requirement would be difficult. As a result the three services have agreed to proceed immediately with prototype development meeting the needs of the Air Force and Army with a capability of meeting the Navy's requirements in the future when the "state of the art" permits. Navy requirements will continue to be a consideration in all plans and decisions." The "state of the art" advances which would affect carrier compatibility were not specified.

### Contract Award

The contract award covers development and construction of five prototype VTOL transports with a cruise speed of 250-300 kt., payload of 8,000 lb. and radius of action of 200-300 naut. mi. at full payload.

Vought is prime contractor and will manufacture the prototype. Hiller has a subcontract for the development of "dynamic systems" which include the power transmission between the engines and the propellers and all the control systems and drives involved in the transition between vertical and horizontal flight. In running the trouble-haunted X-18 program, Hiller has acquired a relatively thorough knowledge of these systems. The subcontract to Ryan covers development of "light-weight structures."

# Mercury Shot Set; Circuit Faults Found

Fourth Mercury-Atlas (MA-4) launching has been rescheduled for next week and two Atlas missile tests were to be put back on the schedule after the entire Atlas test program was postponed to replace defective transistorized circuits in autopilots and programmers.

The MA-4 launch is designed to check Mercury capsule systems and the communications network in a single earth orbit.

Postponement was ordered Aug. 25, just 9 hr. before MA-4 was to be launched from the Atlantic Missile Range, when General Dynamics/Astronautics at San Diego, Calif. located a speck of solder which apparently caused a short circuit in a sealed transistorized package rejected by Atlas personnel at AMR. The short circuit was in the programmer, but the autopilot also contained transistorized circuits from the same manufacturer's lot. Both programmer and autopilot are made by General Dynamics.

General Dynamics declined to identify the supplier, but said the circuit is a standard USAF procurement item. Three companies supply these circuits for the Atlas, which uses 65 transistorized printed circuits in the programmer and autopilot. Suppliers are General Electric, Texas Instruments and Transitron Electronic Corp.

One immediate result of the analyses was X-raying of all sealed circuit packages as part of the quality control procedure.

The circuits, printed on a thin, 8 in. by 6 in. piece of phenolic, are sealed by solder. In the defective allotment, a drop of solder formed inside the unit. The solder speck apparently shook loose in transit and wedged in a transistor to cause a short. This conclusion was reached after one of six rejected MA-4 transistors was cut into thin slices and a solder speck was found.

Several transistors which had checked out in San Diego and then shorted at the Atlantic Missile Range, checked perfectly when they were returned to the San Diego plant. The supposition was that the solder had been shaken into a transistor circuit en route to Canaveral, and then shaken out on the trip back to the plant.

General Dynamics is confident that the defect was limited to one specific batch of circuits and the problem has been solved by the new quality control techniques.

Word of the finding spread quickly to other contractors at AMR, and general studies were ordered by most to investigate these systems in their missiles.

The MA-4 vehicle, designated Atlas 88-D, had checked out and the count was proceeding when the scrub order was given. Replacement parts for programmer and autopilot were ordered and installed on the three Atlas vehicles on pads at AMR.

# Huge Space Chamber Planned for Apollo

**Washington**—Spacecraft environmental test chamber 100 ft. in diameter is being planned to accommodate full-scale Apollo vehicles at National Aeronautics and Space Administration's projected manned Space Flight Laboratory.

The spherical test chamber and an elaborate mission simulator will be the major features of the laboratory, which also will house spacecraft management and astronaut training elements for the Apollo program.

Concern that the laboratory will duplicate existing Defense Department and industrial facilities has been expressed, but a NASA spokesman said nothing like the environmental chamber or simulator presently exists.

Full scale Apollo vehicle concepts (AW July 31, p. 29) range in length from 34-52 ft., and in diameter from 10 to 13.5 ft. The planned chamber will be large enough to permit firing reaction control jets in tests of internal burning and outgassing. These jets will develop about 100 lb. thrust.

Facility will be used for general hardware testing, with cryogenic pumping included in the multi-stage pump system. Vacuum may be as low as $10^{-8}$ mm. of mercury.

The simulator planned for astronaut training will be capable of checking out star tracking systems, and providing celestial navigation and procedures training with an analog link.

Construction of the spacecraft environmental simulator has a cost estimate of $26 million.

Space Task Group at Langley Field, Va., which will staff the new laboratory, is greatly expanding its procurement and contracting capability in anticipation of the large spacecraft workload to start later this year.

Dave W. Lang, formerly deputy director for materiel and the B-70 aerospace systems division at Air Force Systems Command's Wright Patterson AFB, has been appointed chief of STG's purchase and contracts branch. This branch has grown since January from 20 to 42 people, and will exceed 100 by next July. About half the staff are specialists in fields such as negotiations and price analysis.

Bids on the Apollo spacecraft are due at Langley Oct. 9 (see p. 23) and an award will be made in December.

# News Digest

**British Aircraft Corp.** has submitted a Mach 2.2 transport design to the Ministry of Aviation a month ahead of deadline. Meanwhile, Bristol Aircraft Corp. is modifying Fairey Delta II wing for supersonic flight research, in tandem with low speed Handley Page 115.

**Interstate Commerce Commission** last week advocated Federal subsidies for railroads to support essential passenger services. The plan, proposed before the Senate surface transportation committee, would cost about $52 million at the start.

**Senate** last week abandoned its air piracy bill, which relied on application of marine piracy law, and adopted a House-passed version (AW Aug. 28, p. 41) that for the first time makes hijacking of aircraft a federal crime punishable by death.

**Kaman Aircraft Corp.** reported a sales increase to $27.7 million for the first six months of 1961 from $23.4 million for the same 1960 period. Net earnings rose from $290,358 to $387,316, and earnings per share from 69 cents to 85 cents.

**Discoverer XXIX** was successfully launched into a 91.4-min. orbit from Vandenberg AFB, Calif. last week in another phase of the effort to refine the reliability, altitude control, and impact accuracy of the production line satellite system.

**Lockheed Aircraft Corp.** has reached an agreement with Petro-Tex Chemical Corp. to acquire Petro-Tex's 50% interest in Grand Central Rocket Co. This would make Lockheed sole owner of Grand Central. B. C. Monesmith, Lockheed vice-president for manufacturing, will be president and general manager of the Grand Central division.

**East Africa Airways** has ordered three Fokker F.27 Friendship transports from the Royal Netherlands Aircraft factories for delivery in 1962. Cost of the transaction is estimated at $3.25 million including spares. Friendships will replace Douglas Dakotas on the carrier's domestic network.

**Civil Aeronautics Board** last week attributed the accident involving an American Airlines Electra at La Guardia Airport last September to the pilot's failure to plan his approach and estimate the aircraft's height above the ground properly. The Electra struck a dike at the approach to the runway and flipped over. All aboard survived.

# AIR TRANSPORT

# Passenger Fare Cuts Expected to Spread

## Industry hopes to arrest downward swing in traffic but splits over what types of special rates to use.

By L. L. Doty

Washington—Current rash of airline passenger fare reductions, introduced only 18 months after a successful campaign to raise the general fare level, is now expected to spread even further as a means of arresting the downward swing in passenger traffic.

Promotional fares filed with the Civil Aeronautics Board in the past few months—now totaling 12—have been a windfall to the passenger but have split the industry wide open in disagreement over the type of special rate that will open new markets and generate a larger volume of business. The new fares have transformed airline ticket offices into bargain sales counters which offer today's traveler a wide variety of marked-down trips.

Acting with little apparent hope of expanding first-class business, which has remained virtually static in recent months, airlines now are focusing attention on surface travelers as the source of the next major travel market. Chief question to be answered, and the origin of industry disagreement, is which of the new fares will actually develop new traffic instead of merely diverting existing traffic to lower fare categories.

Another unknown factor is whether the last fare increase granted the trunklines by the Board in June of last year may have been an underlying cause of current traffic depression. The fare increase of approximately 5% closely coincided with the beginning of the leveling-off of passenger revenue miles (AW June 27, 1960, p. 41).

It also was in June of last year that coach traffic first began to surpass first-class traffic as the dominant class of air travel. In July of this year, coach accounted for more than 62% of all traffic handled by the trunklines, compared with 54% in July of 1960. The upward trend has been consistently strong.

A majority of industry officials feel, however, that the traffic depression is due to such causes as the general economic condition of the nation, the sudden surge of available seat miles stemming from the introduction of the jet and the strong possibility that the present air travel market has been all but saturated.

To offset these factors, industry now feels that promotional fares must be used to develop new markets. Here are the fares that have been introduced within the past five months to achieve this goal:

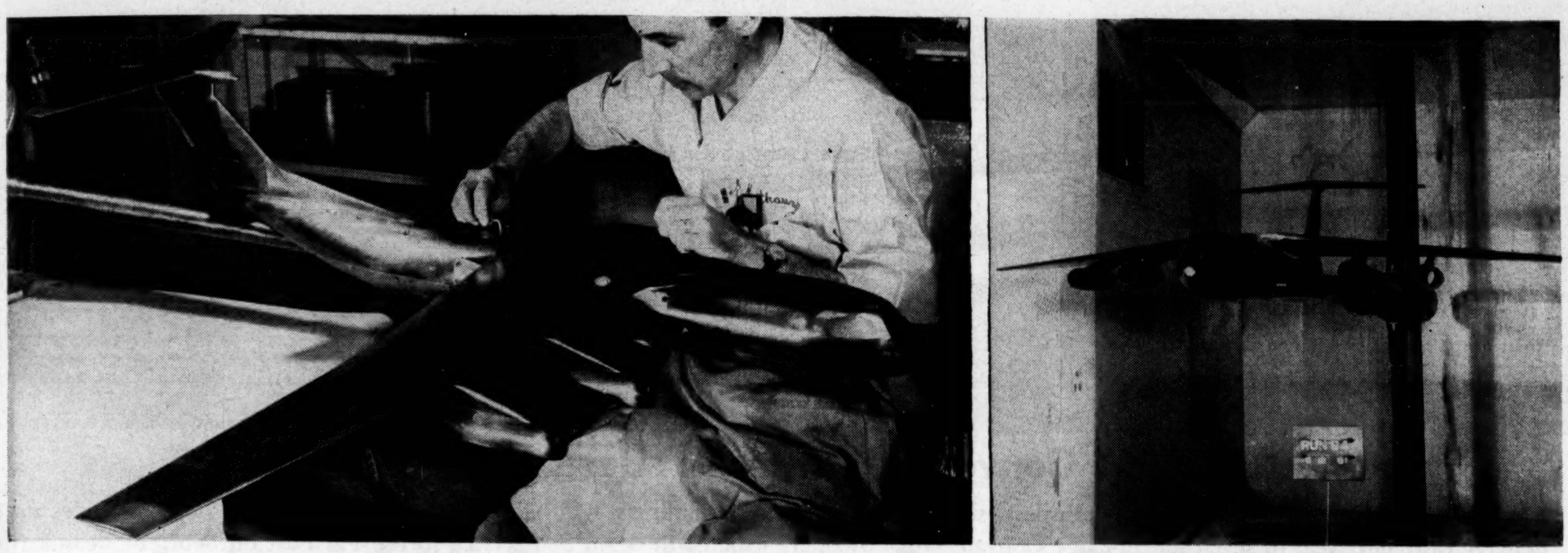
- **Youth fares.** A 50% reduction on basic first-class fares restricted to passengers between the ages of 12 and 21 yr. Reservations may be made only within the 3-hr. period before flight time. Eastern, Braniff, Mohawk and Pacific filed complaints with the Board requesting investigation and suspension of the tariff but the Board dismissed the complaint and approved the fare.
- **TWA excursion fare.** A coast-to-coast round-trip fare of $198 on jet aircraft and $178 on propeller aircraft. Travel is restricted to the period between 12 noon Monday and 12 noon Friday. Return trip must be taken not earlier than 13 days after initial departure nor later than 30 days. Both American and United filed for the excursion rate, which is now in effect, but protested the tariff. Delta and Continental also filed for the rate.
- **Braniff night coach family plan.** Accompanying members of the head of a household are entitled to a 50% discount when using Braniff night coach trips.
- **Allegheny commuter service.** The first of reduced rate, no-frill, no-reservation commuter services.
- **Eastern Air Lines air shuttle.** Every-hour-on-the-hour shuttle service between Boston and New York and New York and Washington. No reservations are accepted, no extras are offered the passenger. Fare is about 14% to 17% lower than present day coach fare.
- **Eastern airbus.** No-frills service. Purchase of a ticket becomes the passenger's reservation. Service is offered between limited points at reductions ranging from 11% to 30% of present day coach fares.
- **Mohawk golden age fare.** Women 62 or older and men 65 or older are eligible to join the golden age group by paying a membership fee of $5. Membership card entitles travelers to an approximate 33% reduction of one-way fares on Mohawk routes.
- **Bonanza air-tour.** Bonanza has filed for a tariff that would permit passengers to unlimited travel on the Bonanza system for 15 days at a full rate of $90 or 30 days at $160. Only travelers living outside the Bonanza area would qualify for this special fare and original transportation would have to begin in the U. S. east of the Mississippi, in Alaska or Hawaii, or below the 35th Parallel in Mexico.
- **Bonanza youth fare.** Bonanza offers a round-trip half fare for all youths between 12 and 21 without restrictions on reservations. Purchase of an annual youth identification card for $2 is required to qualify for the low fare.
- **Trans-Texas short-haul markets.** Carrier has cut fares to stimulate travel on short-haul routes such as Beaumont, Tex.-Lake Charles, La.
- **Ozark excursion fare.** Excursion tariff calls for a 70% discount on the return portion of round-trip tickets covering 41 points on its system. Travel must be completed within 11 days.
- **Northwest Airlines excursion fare.** Northwest has filed a tourist-class excursion rate between cities in the East and Hawaii. One plan calls for passage between eastern cities and Seattle on piston engine aircraft and between Seattle and Hawaii on jet aircraft at a round-trip rate of $444. A second plan covers an all-jet flight between eastern cities and Hawaii at $484. Present tourist fare by jet between Washington and Honolulu is $532.50. Excursion fare will be effective seven days a week

### FEIA, National Sign

**Washington—Flight Engineers' International Assn. has signed an 18-mo. contract with National Airlines providing pay increases for engineers on all types of aircraft and continued use of a three-man crew aboard National's jets.**

**The contract, which is retroactive to last July 1, is the first signed by the union with any of the seven airlines shut down by last February's engineer strike.**

**Representative pay increases for a top seniority engineer flying half days and half nights, 85 hr. per month are: Douglas DC-8, raised from $1,445 to $1,658; Lockheed Electra, from $1,146 to $1,336; Constellation 1049-H, from $1,054 to $1,235; Douglas DC-6B, from $925 to $1,135.**



## Lockheed C-141 Design Undergoes Pressure-Distribution Test

**Pressure-distribution model of Lockheed C-141 cargo transport for military and civilian roles is shown being mounted and tested in Cornell Aeronautical Laboratory's transonic tunnel. Tests will produce data for structural design of the full-scale airplane. Two models have been tested so far in the program: a Lockheed-built model and this Cornell lab model, spanning four and one-half feet and valued at about $120,000. First results have been obtained and are being reduced and transformed for engineering use. Initial wind tunnel contract with CAL is for $375,000, with probable increase to $700,000 for future additional tests. Lockheed Georgia Co. will build 132 of the planes under current planning, with rollout of first plane scheduled for July, 1963. Delivery should begin in June, 1965.**

on round trips of more than 13 and not less than 30 days.

- **American Airlines** special promotion Ft. Worth-Dallas fare. American wants to offer a round-trip fare between the two points that will equal the current first-class, one-way fare. Return trip must be made within 24 hr. of departure.

One victim of the new fares is the airline ticket agent, who must now construct fares through the use of timetables, maps and passenger credentials on tariffs that are as complex as they are divergent. Interline revenue auditing and accounting will be equally as intricate.

Early signs indicate that the new fares may help bolster airline business. Last week, American said its reservations and ticket offices were "flooded" with inquiries on the half-fare youth plan, which went into effect Aug. 30. Carrier's Washington office had 600 inquiries on the discount rate within a 10-day period, American said.

Of the 11 trunklines, only Eastern refused to file for the youth fare. Central, Chicago Helicopter and Trans-Texas joined the 10 trunklines in filing for the plan.

In its request for suspension and investigation of the youth fares to the CAB, Eastern said American's proposal would "precipitate traffic and operating problems, wastefully increasing costs and needlessly diluting revenues." It pointed out its own efforts to develop new traffic through promotional fares and then added:

"In contrast, the American proposal is directed only at an already well-developed segment, delineated according to age group without reference to the method of travel, and is offered in such a way as surely to increase expenses and create difficulties in passenger handling."

United did not file a formal complaint but gave the Board a statement expressing its concern with the proposal. It urged the Board to collect data which would serve to evaluate the effectiveness of the new fare in increasing revenues.

As a result, the Board directed each carrier to file factual summaries of its experience with the youth fare plan after every three-month time period.

### Hovercraft Development

**London—Vickers-Armstrongs, working with Hovercraft Development, Ltd., is building a four-place utility machine at its Marston plant, aimed at demonstrations as an executive transport over sheltered waters in overseas sales markets.**

**The Hovercraft, designated VA-2, is air-transportable, with two fin and rudder assemblies and complete propulsion unit detachable to facilitate loading. Powerplants will be three piston types—two for lift, and one for propulsion. Decision on engine make has not been made. The VA-2 is 28 ft. 4 in. long, 14 ft. 10 in. wide and 10 ft. 4 in. high. It will be completed in about five to six weeks.**

**Vickers also is building a VA-3 Hovercraft, a 10-ton vehicle designed for fast passenger or troop transporting to operate in river conditions with waves up to two feet. Payload will be about 4,000 lb. plus crew for 80 naut. mi. Powerplants currently are four Blackburn Turmo turbines, but Vickers said design is flexible enough to use alternative units. Dimensions are 52 ft. 6 in. in length, 25 ft. wide and 17 ft. 9 in. high.**

**Advanced design team is working on design of a VA-4 large ferry Hovercraft, with a 49-ton payload and speed of up to 80 kt.**

TWA reported a 50% increase in transcontinental jet coach traffic during the first five days the round-trip excursion rate was in effect. The airline noted that there was no apparent diversion of regular full-fare coach traffic during the period.

It said that, of the 10,709 coach passengers who flew on the route during the first five days, 3,449 or 32% used the excursion rate. Regular coach travelers, the airline said, totaled 7,260, which was an increase over the 7,138 total coach volume in the same five days before the excursion fare became effective.

TWA will expand its excursion fare program to include other sectors of its system—a move that will inevitably draw protests from American, which holds that fare reductions will only depress revenues unless it can be proved that such rate cuts will attract new business.

Meanwhile, a number of minor changes in rates and services are being undertaken in the continuing competitive struggle for traffic. United will drop the reconfirmation rule, for example, on Oct. 1. Helicopter airlines are working out interline agreements with trunklines to permit through rates that result in sizable reductions of fares covering the helicopter leg of a flight.

The industry also is ministering to its first-class passengers with an abundance of frills and extras in a drive to retain the present volume of this class of business. In this effort, the industry is being frustrated by a growing number of firms that are directing their employes to travel coach whenever practicable. A number of government agencies and departments have taken similar steps as a result of a recent cost study conducted by the General Accounting Office.

SWISSAIR
HB-ICL

## Leased Convair 880s to Be Used by Swissair

**Leased Convair 880 medium-range jet transport, shown here in Swissair markings, will be used over the carrier's Far Eastern routes until delivery early next year of seven longer-range Convair 990s. Swissair, which will begin 880 service to the Far East on Sept. 15, leased two of the transports from Convair after delivery delays in the 990. They will be returned to Convair when the 990s are on hand.**

# Air Taxis Offer Service to Cities Unable to Support Local Airlines

**By Robert H. Cook**

**Washington**—Determination of the Civil Aeronautics Board to hold the line on its mounting subsidy bill is facing a policy challenge from air taxi operators, who are requesting the right to provide a third category of air service to communities unable to support local airline operations.

The Board is accelerating its "use it or lose it" authority to help local service operators reduce subsidies. It now faces the question of whether to restore service to many points dropped by local service lines. Air taxi operators argue that subsidy might be unnecessary or considerably lower for each city because of their lower operating costs.

Three air taxi operators, Hi-Plains Airways of Hill City, Kan., B&K Airways of West Chicago, Ill.; and Dixie Airways of Lanett, Ala., already have applied for this new type of service, to be conducted with light business-type aircraft on predominantly VFR schedules. Central Airlines, a local service airline, also has asked to be considered for such a service.

### CAB Studies Concept

Under a Board proceeding already under way, CAB is investigating the practicality of this new concept. By the end of this year it is expected either to reject the idea or select one applicant to provide the service on an experimental basis for a limited period.

Frontier Airlines' efforts to drop several unprofitable points in Nebraska under a temporary suspension granted by CAB is credited by most industry observers with creating a practical and timely opening for the applications filed by the air taxi operators. Frontier, a local service carrier, has continued to serve the Nebraska stops under an injunction obtained by the state, pending a final decision from CAB on the abandonment.

In effect, CAB consideration of a third category of service will require a searching re-examination of its present thinking on subsidy payments and route expansions. Observers contend that the Board has clearly indicated, under its "use it or lose it" authority, that federal funds should not be used to support airline service to communities that have proved they cannot support such service. In conjunction with this, CAB's new "class mail rate" subsidy formula (see p. 43) also is designed to assure that a maximum amount of subsidy payments is provided for those cities which consistently generate the most traffic revenues. Granting of the air taxi applications would not only amount to a reversal of this policy, these observers believe, but would place CAB in the same position it was in more than a decade ago, when the struggling local service industry claimed it needed larger and faster aircraft, along with longer routes and heavy populations, in order to make a profit.

Beyond the basic policy issue, CAB also must consider several technicalities which the use of light aircraft in daily scheduled service might bring. Among them are the possibility of a new and separate type of Federal Aviation Agency traffic control procedure, since many of the proposed flights would serve such heavily congested areas as Chicago, Atlanta and Denver.

Most of these plans also are based on the assumption of single-pilot operation during IFR weather, raising a question of whether this can be done under present Civil Air Regulations. Any requirement that these IFR flights be operated with two pilots also could raise aircraft operating costs and eliminate an available seat needed for revenues. None of the applicants has submitted detailed plans of its proposed operations, Board spokesmen said, so it is not yet possible to determine just how much subsidy would be required.

Hi-Plains asked the Board for "indefinite" authority or a minimum certificate for seven years. A fleet of 10 six-passenger Aero Commander aircraft would be leased or purchased to provide a daily schedule pattern of two round trips connecting 47 cities over four routes. Most of the points are now on the route systems of Frontier, North Central and Central Airlines, and would be served as intermediate points between the major cities of Denver, Omaha, Wichita, Bismarck and the home base of Hill City.

During a prehearing conference, the company also agreed not to request permanent certification or the use of aircraft over 12,500-lb. maximum gross landing weight, and agreed to accept any competitive restrictions imposed by the Board.

### B&K Airways

B&K Airways, now connecting the community of St. Charles about 50 mi. west of Chicago with that city's O'Hare and Midway airports, plans to use Cessna or Piper Apache equipment on five routes, including service to E. St. Louis and Dubuque, Iowa, covering 13 intermediate points. B&K estimates its average daily passenger boarding for each city would be less than seven passengers, but told the Board it would accept a certificate without subsidy provision.

Dixie Airways, which has not been included in the present CAB hearing, asked for 16 different routes serving 58 cities in the states of Georgia, Alabama, Tennessee and Florida. Piper Aztec aircraft, and later Beechcraft Super G18s on de Havilland Doves, would be used.

# Halaby Hopes to Bring Decorative Touch to FAA's Ground Facilities

**Washington** – Federal Aviation Agency Administrator Najeeb E. Halaby, whose interest in the arts is evident from the new decor of his office, is now hoping to inject a similar decorative quality into the agency's aviation facilities.

Halaby's first targets in the proposed interior decorating program are the new Air Route Traffic Control Center in Nashua, N. H., where he wants to replace a factory appearance with an interior setting more artistically pleasing to the eye, and the new terminal at Dulles National Airport, which he feels should impart a theme of "Americana" to air travelers. The plan is designed to erase the drabness of ordinary buildings. Halaby has decorated his own office with a series of abstract paintings.

Meetings are now in progress within the FAA to explore the practicability of giving the Nashua center a more pleasing touch. If this attempt is successful, the program will be expanded to brighten other ARTC buildings throughout the U. S.

But, FAA's Bureau of National Capital Airports apparently has already made an affirmative move toward transforming Halaby's desire for artistic settings into reality. In a memorandum to hopeful proponents seeking food and beverage concessions in the Dulles terminal, the Bureau stresses that it has been deemed essential that "compatible and suitable themes be incorporated into the interior decor of the de luxe dining room and the adjacent beverage lounge which are cognizant of the fact that patrons will be devoting sufficient time to enable their detailed appraisal and admiration of the American expressions portrayed."

It is up to the bidders to provide the decor. In fact, bids will be rejected unless a "minimum of one expression" is submitted prior to 4 p.m., Sept. 8. The memorandum said the government will "benefit from the originality, thoughtfulness and initiative displayed by each of its proponents, and at the same time, preserve the competition which currently exists for the concession rights."

The memorandum suggested that plans do not necessarily have to be "lavish" but that the "content be sufficient to clearly illustrate the decor theme offered" and that a "narrative which states the expression or story being portrayed" accompany the bid.

Bidders were invited to develop any theme they wished but the memorandum contained what might be called a hint:

"With no intent of limiting the freedom of expression or manner of portrayal, the government points out the stirring history of our nation, the striking beauty and vastness of our lands, the drama and excitement of our social, cultural and political progress and the challenging future of the space frontier."

To emphasize the extent to which the theme should be carried, the memorandum said "the government desires to point out the suitability of the ability of cuisine and appointments to carry out or support a decor theme."

It was admitted that the request for suggestions of interior decorations can alter the terms of offers previously submitted but FAA added: "In this respect, all proponents are invited to amend their original proposals in any manner deemed necessary by them as a result of complying with this request on the part of the government."

To make certain that art-for-art's-sake would not be a prevailing requisite, the memorandum said that ". . . submission of the most suitable offering under this request would not operate to exclude all other factors being considered by the government in the award of this concession right."

To make certain that the significance of art will not be subordinated to more material considerations, the memorandum noted that the suggested decor will "constitute a major factor in the award, and will govern if the government determines" that all other requirements are met.

# Supplemental Carrier Bill Passed by Senate

**Washington**—Senate last week passed a bill designed to give permanent status to supplemental air carriers without providing harmful competition to the scheduled air lines.

The measure defines charter service for the first time and gives the Civil Aeronautics Board less authority than it had formerly over supplemental carriers by requiring the Board to follow criteria set forth by Congress.

The Senate passed the bill substantially in the form in which it was approved by the Senate Commerce Committee (AW Aug. 7, p. 30). One amendment sponsored by Sen. Clair Engle (D.-Calif.) and adopted by the Senate stipulates that cargo carriers as well as passenger carriers may provide charter service.

Chairman A. S. Mike Monroney (D.-Okla.) of the Senate Aviation Subcommittee said the bill "seeks to provide a permanent place in the aviation industry for supplemental air carriers without adverse effect upon unscheduled carriers."

Supplemental carriers, as a result of several court decisions, are operating under a temporary authority given through an act of Congress. This expires next March.

The major question now is whether the House will pass a supplemental carriers bill before adjournment or wait until early next year.

# National Airlines Lost $7 Million in FY 1961

National Airlines has reported a net loss of $7 million for the fiscal year ending June 30 after depreciation charges of $10.5 million. Operating revenues for the year were $63.9 million compared with $68 million in Fiscal 1960, when a deficit of $2.9 million after income tax credits of $4 million was reported.

The airline reported a net profit of $118,000 for the month of July on total revenues of $7 million, compared with $5.3 million in the corresponding period last year. Operating profit for the month was $318,000.

Reflecting full operation of the carrier's new southern transcontinental route, revenue passenger miles in July climbed 38% to 115.8 million from 83.6 million in the same period last year.

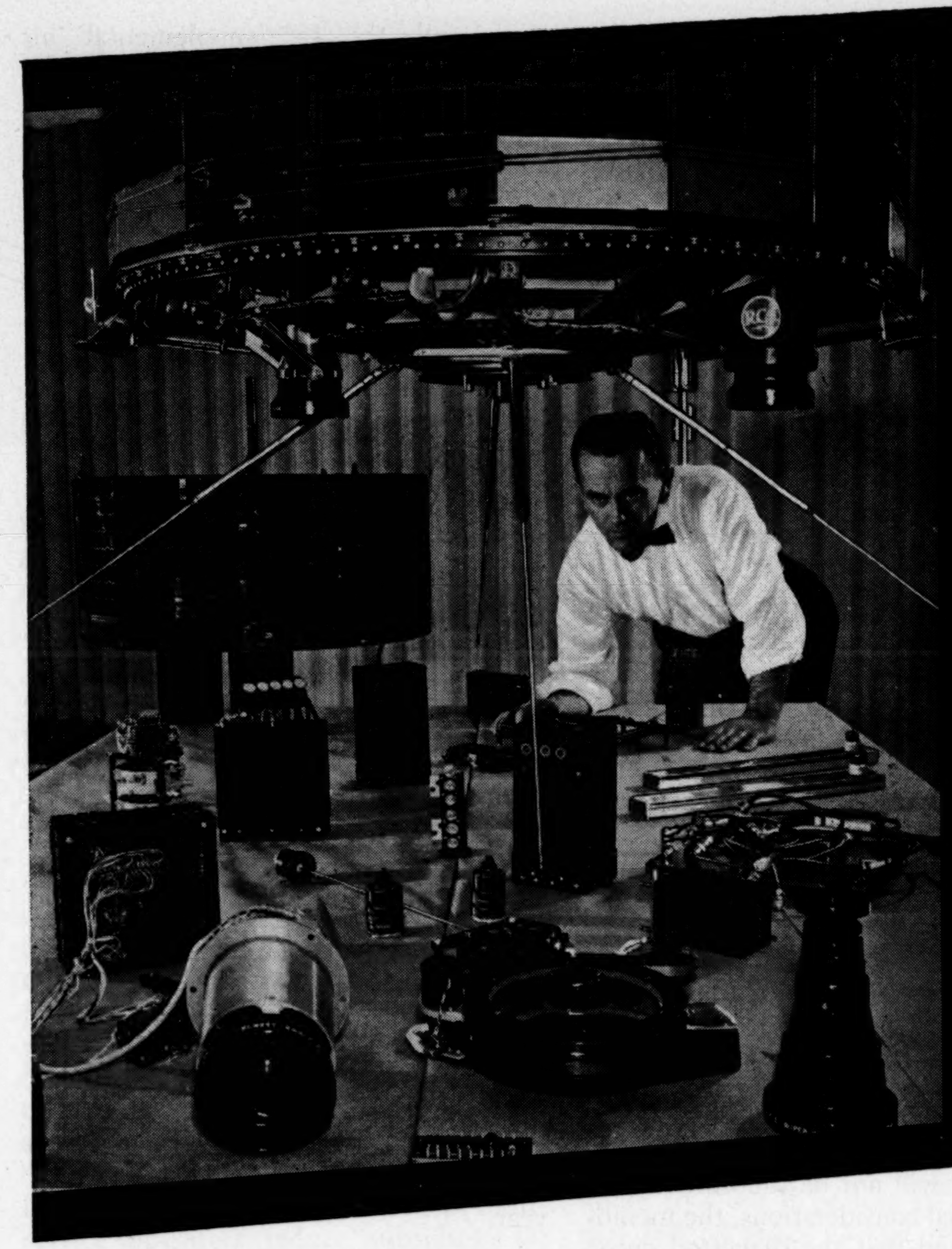
# ALPA to Broaden Southern Pilots' Aid

**Washington**—Air Line Pilots Assn. may carry its 16-month-old battle with Southern Airways to the bargaining tables of all U.S. domestic and international airlines.

Master executive councils of all carriers have been advised to seek contractual agreements that would permit ALPA members to honor the picket lines set up by striking Southern pilots who walked off during a contract dispute in June of 1960.

C. N. Sayen, ALPA president, said the recommendation resulted from a recent meeting called to "mobilize and solidify" all ALPA members behind the regular Southern pilots. He said the decision to seek contract changes under the Railway Labor Act came only after the union had "carefully and conscientiously followed every legal and reasonable procedure with no avail."

More than a year ago the union threatened to shut down airline service to 13 cities served by Southern if the strikers were not rehired, but was blocked by court injunctions obtained by major trunk carriers serving the area (AW Aug. 28, p. 38).



A cross-section of the 40 subsystems incorporating 3500 electronic parts which go into TIROS III are framed by two satellites. All components must be thoroughly tested, precisely integrated and must function perfectly if the satellite is to perform successfully.

# NASA's Hurricane spotting TIROS III maintains projects' fine performance record

With the successful launching of TIROS III, meteorologists for the first time will see the total cloud formations and measure the radiative energy balance of hurricanes which plague the eastern coast of North and Central America each year. For TIROS III was launched at this time for precisely this purpose. From information gained from TIROS III, meteorologists may learn much more about the birth and life cycle of tropical storms.

## TIROS III DESIGN

Although the spacecraft configuration is essentially the same as the previous two highly reliable TIROS satellites, TIROS III has two wide-angle cameras and the National Aeronautics and Space Administration has placed new omnidirectional IR sensors aboard to measure thermal radiation from the earth and sun.

## THIRD OF A FAMOUS FAMILY

TIROS III is the third of a highly successful series of experimental weather satellites which were developed, along with the associated ground equipment, for the NASA, under contract with the Goddard Space Flight Center, by RCA's Space Center. All of them have established "firsts" in the United States' space program.

TIROS II established a longevity record for a complex satellite. Still operating after nearly eight months and over 3300 orbits, TIROS II has transmitted over 34,000 photographs to the ground. Aside from its impressive meteorological achievement, historians may well point to this long-term performance as the first to prove that a satellite system could operate reliably for so many months in a space environment thus proving the feasibility of operational satellites.

TIROS I was the first satellite, carrying advanced television equipment, which sent photographs of the earth's cloud cover to meteorologists. From TIROS I's 23,000 photographs, meteorologists found that satellites could be used for weather observation and analysis. The pictorial information is particularly useful in the two-thirds of the world from which few or no weather observations are now available.

## CONNOTATIONS FOR THE FUTURE

The TIROS series has proved beyond a doubt that the peaceful uses of space will benefit all mankind. Six nations participated in the utilization of information from TIROS II and more will take advantage of TIROS III. RCA is also already at work on the camera systems and space power supply for NIMBUS, the next generation of meteorological satellites.

If you are a professional physicist, engineer, or mathematician and interested in participating in such challenging projects and stimulating team efforts, contact the Employment Manager, RCA Astro-Electronics Division, Defense Electronic Products, Princeton, N. J. All qualified applicants are considered regardless of race, creed, color or national origin.

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# Class Mail Rate Subsidies Raise Local Carriers' Profit Potential

**Washington**—Profit potential of local service operations took a sharp swing upward in the second quarter of this year under the Civil Aeronautics Board's new class mail rate system of subsidy payment.

The removal of all 13 local service airlines from temporary mail rates, which provided only breakeven subsidy needs, and their placement on final rates under the new system generated operating profits totaling more than $3.4 million for the quarter, compared with a $215,573 operating loss for the same period last year.

Breakeven need of the carriers in the second quarter increased only 4.3%, for a total of $12.4 million. Total subsidy payments made in this quarter amounted to $15.9 million, an increase of $3.8 million over the same period of 1960.

Commercial revenues earned by the carriers were up $5.6 million and accounted for $29.3 million of the industry's $45.2 million in total operating revenues. Total operating expenses reached $41.8 million for a gain of $5.8 million over the second quarter of last year.

Based on a flexible formula that tailors subsidy payments to the airlines' daily plane miles per station, the new class rate system has recorded the most dramatic profit progress in an analysis of operating profits expressed in cents per revenue plane mile.

More than half of the local service operators were able to reverse second quarter losses, which ranged from 5.12 cents to 28.43 cents per revenue plane mile, to operating profits reaching from 12.31 cents for Central Airlines to a high of 27.05 cents per revenue plane mile for Mohawk Airlines. Lake Central increased its revenue yield from 4.05 cents in the same comparative period to 5.87 cents in the second quarter of this year.

## Operating Losses

Four other carriers—Trans-Texas Airways, Ozark Air Lines, North Central Airlines and Frontier Airlines—sustained operating losses ranging between 0.38 cents to 6.52 cents, primarily because of varying dates of application of the new rate and adverse weather conditions which affected their operations during the quarter.

Although these figures are encouraging and should place several carriers under the profit sharing phase of the class mail rate, industry sources point out that expected CAB changes in the formula may reduce this rate of profit growth.

## Carrier Operating Profits

Local service airlines ranked by increase in operating profit second quarter 1961 over 1960.

(cents per revenue plane mile)

**Operating Profit (Or Loss)**

| | Increase | | Second Quarters | |
|---|---|---|---|---|
| **CARRIER** | **Rank** | **Amount** | **1960** | **1961** |
| **Pacific** | 1 | 49.49 | (28.43) | 21.06 |
| **West Coast** | 2 | 36.59 | (14.67) | 21.92 |
| **Mohawk** | 3 | 36.47 | (9.42) | 27.05 |
| **Southern** | 4 | 35.43 | (22.45) | 12.98 |
| **Bonanza** | 5 | 33.15 | (9.48) | 23.67 |
| **Allegheny** | 6 | 18.67 | (5.86) | 12.81 |
| **Central** | 7 | 17.43 | (5.12) | 12.31 |
| **Piedmont** | 8 | 15.29 | 2.56 | 17.85 |
| **Lake Central** | 9 | 1.82 | 4.05 | 5.87 |
| **Trans-Texas** | 10 | (0.38) | 1.72 | 1.34 |
| **Ozark** | 11 | (3.86) | 14.13 | 10.27 |
| **North Central** | 12 | (5.36) | 12.90 | 7.54 |
| **Frontier** | 13 | (6.52) | 14.20 | 7.68 |

## Comparative Operating Results

Thirteen local service airlines—comparison of operating results second quarters 1961 and 1960.

| | Second Quarters | | |
|---|---|---|---|
| | **1960** | **1961** | **Increase** |
| **Revenues:** | | | |
| **Passenger** | $21,588,264 | $26,825,579 | $5,237,315 |
| **U. S. Mail** | 475,241 | 595,236 | 119,995 |
| **Property** | 1,022,572 | 1,290,415 | 267,843 |
| **Other Commercial** | 640,906 | 651,358 | 10,452 |
| **Total Commercial** | 23,726,983 | 29,362,588 | 5,635,605 |
| **Federal Subsidy** | 12,111,740 | 15,928,199 | 3,816,459 |
| **Total Operating Revenue** | 35,838,723 | 45,290,787 | 9,452,064 |
| **Total Operating Expense** | 36,054,296 | 41,855,533 | 5,801,237 |
| **Profit (or loss)** | (215,573) | 3,435,254 | 3,650,827 |
| **Break-even need** | $12,327,313 | $12,492,945 | $165,632 |

**Prepared by Ray and Ray**

# Minimum Air Freight Rates to Be Revoked

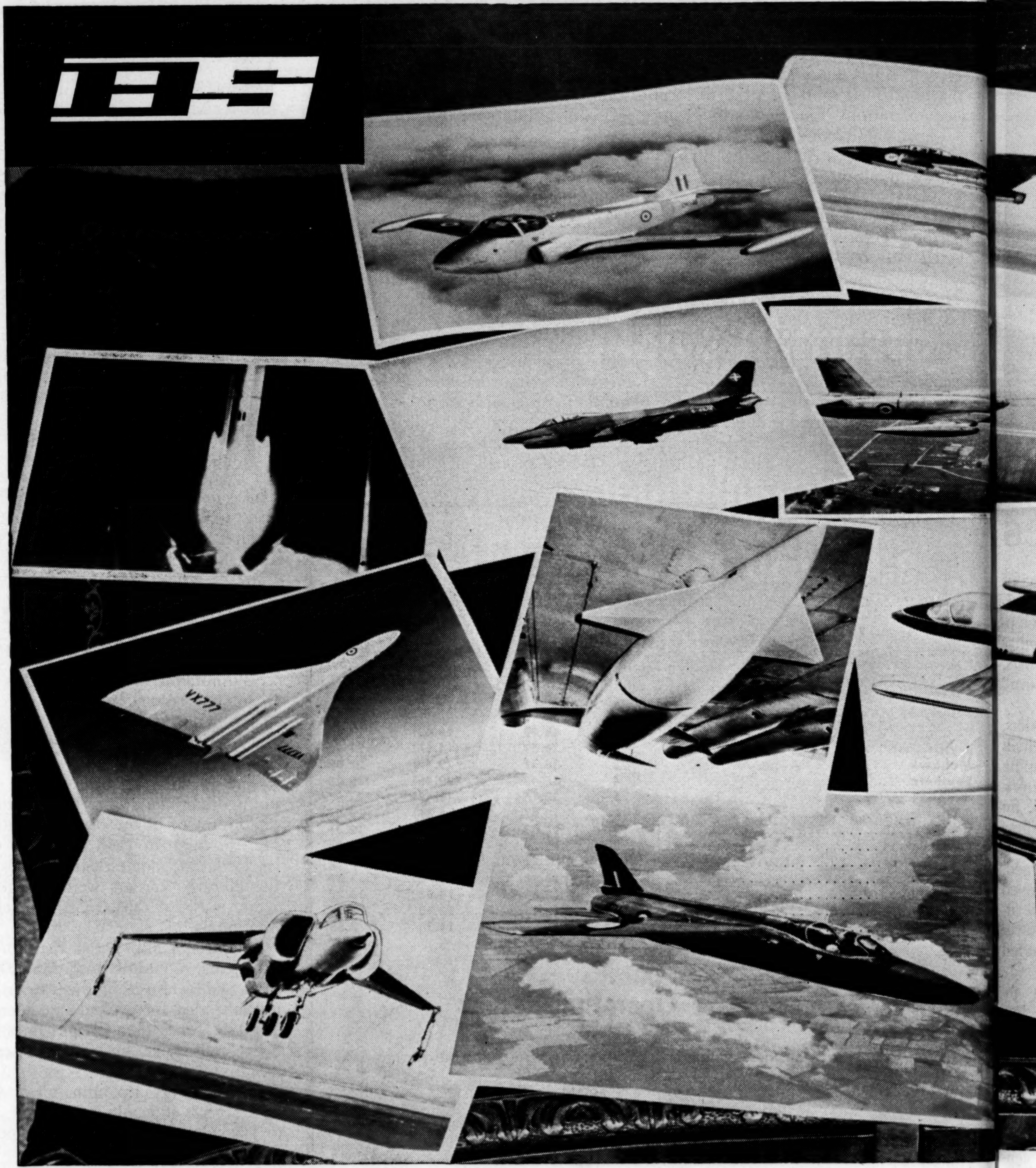
**Washington**—Civil Aeronautics Board has ordered minimum rates for domestic air freight, including assembly and distribution services, to be revoked on Oct. 1.

The Board took the action after noting that conditions leading to the establishment of the original minimum rate for cargo in 1948 no longer exist. In 1948, the domestic trunklines and the all-cargo carriers were engaged in a rate war that caused CAB to set the minimums.

The Board also noted that for several years, domestic cargo rates have been stable. In 1957 the carriers voluntarily filed for general rate increases of 10%. Since then, freight rates have been well above the CAB prescribed minimums.

In revoking minimum rates, CAB told carriers it would not permit rates to fall below economic levels or permit the type of competitive practices which forced establishment of rate floors in the first place. After Oct. 1, rates will be initiated by the carrier, subject to suspension or investigation upon complaint or on the Board's initiative.

The Board said there is prospect of a breakthrough in air freight transportation which may make cargo operations profitable for the first time. New equipment in the form of turbine-powered, all-cargo aircraft offering greatly increased capacity, coupled with modern ground equipment, show promise of economies.



*Airliners, transports, trainers, bombers, fighters, missi*

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## BRISTOL SIDDELEY AERO-ENGINE APPLICATIONS

**Olympus turbojet powers . . .**
Avro Vulcan Mks 1 & 2 V-bombers
BAC TSR 2 tactical/strike aircraft

**Pegasus turbofan powers . . .**
Hawker P 1127 VTOL strike aircraft
Fokker/Republic VTOL fighter

**Sapphire turbojet powers . . .**
Gloster Javelin all-weather fighter
Handley Page Victor Mk 1 V-bomber

**Orpheus turbojet powers . . .**
Fiat G 91 strike fighter
Fiat G 91 T trainer
Folland Gnat light fighter
Folland Gnat trainer
Fuji TIF 2 trainer
Hindustan HF 24 fighter

**Viper turbojet powers . . .**
De Havilland Jet Dragon executive transport
Piaggio/Douglas 808 executive transport
Hunting Jet Provost trainer
Macchi MB 326 trainer
GAF Fairey Jindivik target drone

**Proteus turboprop powers . . .**
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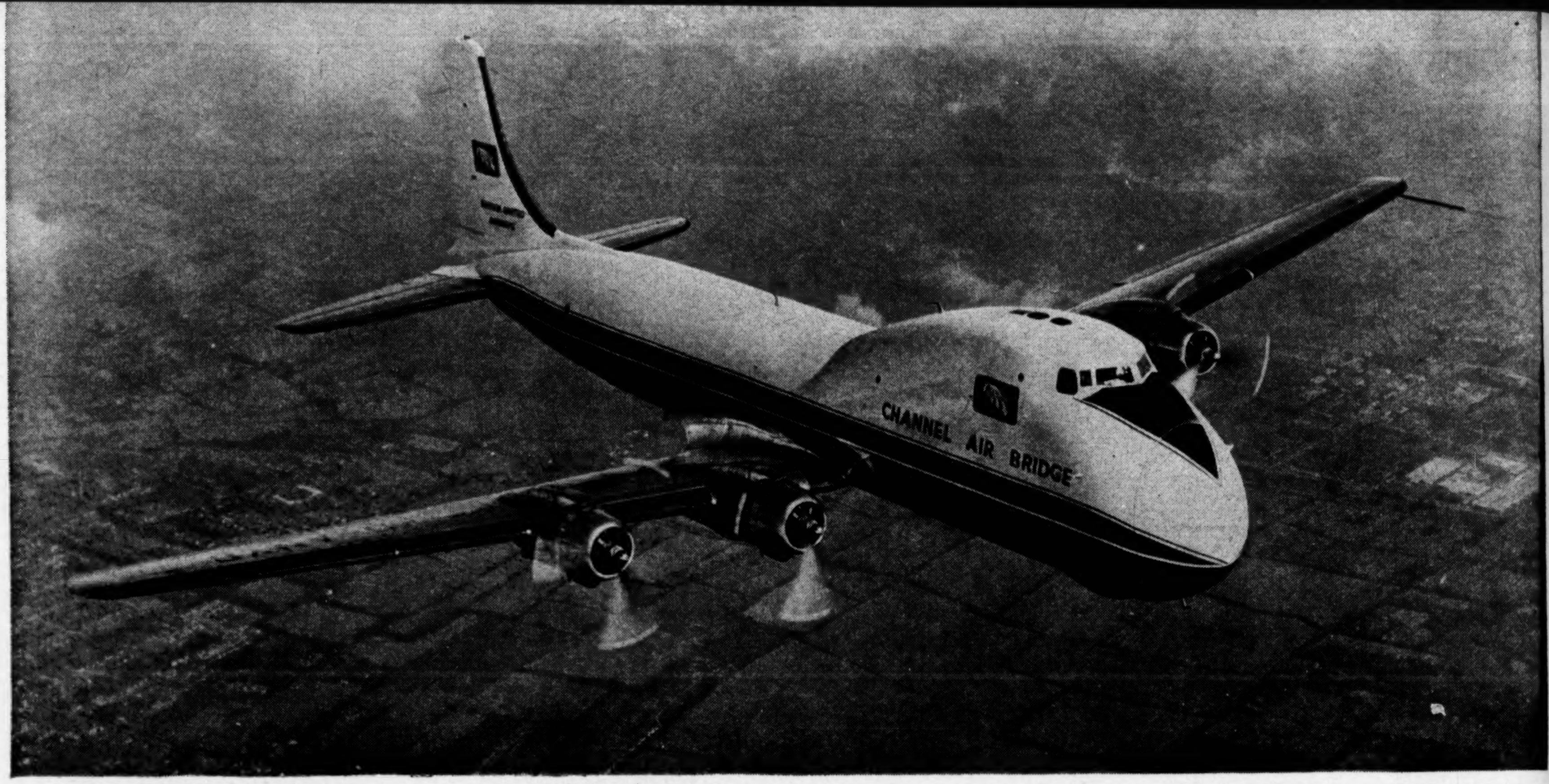


**FIRST CARVAIR,** forerunner of 10 DC-4s to be modified for Channel Air Bridge, is shown during a recent test flight.

# Carvairs Scheduled for U.K.-Swiss Routes

**London**—Channel Air Bridge will start development of a new United Kingdom-Switzerland route next spring, hauling cars and passengers in an airplane precisely designed for the job.

The aircraft is the ATL-98 Carvair, a Douglas DC-4 (AW July 17, p. 127) now undergoing flight testing for Air Registration Board certification, at Southend-on-Sea, where Aviation Traders, Ltd., is building 10 of them.

Flight test program, which had been described as highly successful to date, with no major snags reported, suffered a setback of at least 30 days when a workman drove a forklift into the tail section of the ATL-98 nearly cutting it from the airframe. Rebuilding started immediately.

The routes, first scheduled service into Switzerland approved by the British Air Transport Licensing Board, will connect Southend with Basle and Geneva, subject to Swiss government approval. Channel Air Bridge will fly up to five flights a week to both cities.

The airline, a division of British United Airways, began its deep penetration move by requesting permission to fly to Lyons and Strasbourg, France, on the basis of a customer survey. The French government refused the request, primarily because of pressure from French railways and the tourist industry, which prefer to have cars driven through France rather than flown over most of the country.

Channel Air Bridge then turned to the Swiss cities where construction of the Great St. Bernard road tunnel—connecting Switzerland and Italy—was an important consideration to the traveling motorist. This 3-mi. tunnel will be completed in 1962, vastly speeding surface journey between Switzerland and other southern European points.

The airline's operational philosophy of low-altitude, off-airways flight planning, backed up by Decca navigation system in the cockpit, has been proven on its runs to Calais, Ostend and Rotterdam. Channel Air Bridge said it will continue this method, as far as practicable, to Switzerland.

It was this philosophy, in part, that set the design parameter for the Carvair, an idea credited to F. A. Laker, executive director of the Air Transport Division of British United Airways. Specifications, laid down four years ago for an aircraft to replace the Bristol Mk. 32 freighter, called for four piston engines, 200-mph. cruise speed, 70 ft. of car space, 20-25 passengers, payload of about eight tons and low initial cost.

Turbine power was considered, and then dropped, because of high initial cost and the economic necessity of keeping to high altitudes in this type of airplane. Prime consideration in adopting the conversion method of developing a new carrier was the availability of Douglas DC-4s and reasonable costs, combined with addition of a "hump" nose to facilitate loading.

### ATL-98 Carvair

| | |
|---|---|
| Length | 102 ft. 7 in. |
| Span | 117 ft. 6 in. |
| Height | 29 ft. 10 in. |
| Basic weight (furnished) | 40,730 lb. |
| Takeoff weight (maximum) | 73,800 lb. |
| Landing weight (maximum) | 64,170 lb. |
| Payload (maximum) | 16,800 lb. |
| Baggage volume | 151 cu. ft. |
| Cruise speed (2,500 ft., 65,000 lb.) | 200 mph. |
| Payload range (no reserve) | 2,160 stat. mi. |
| Maximum range (no reserve) | 3,325 stat. mi. |

The job went to Aviation Traders, another British United Division, which started with a Braniff DC-4, stripping the engines, tail and nose and removing the fuel tanks. Tail vertical fin was extended to cope with airflow changes caused by the hump nose.

The DC-4 cockpit, slightly enlarged, was retained but controls were removed for a complex relocation job. Nose itself is constructed in upper and lower halves in separate jigs and then mated in a single jig.

The Douglas nose wheel was retained, but faired over to keep the low floor level. Nose door is opened and closed by a hydraulic hand pump.

Channel Air Bridge said the first Carvair had flown 70 hr. in its test program and certification was expected by October, until the accident. Carvair has been flown with an extended aft center of gravity, using water ballast tanks to change the center of gravity. Speed range has been run up to 276 mph. indicated airspeed (demonstrated diving speed) with no signs of aerodynamic buffeting due to the shape of the new nose section.

Carvair also has completed a maximum weight takeoff and propeller strain gage test, conducted by de Havilland Propellers. Airplane has been flown by an ARB crew and European representatives of Federal Aviation Agency have inspected the Carvair.

At least one U. S. manufacturer is considering manufacturing the Carvair under license because of the interest expressed by a number of overseas airlines. Aviation Traders also is considering a kit conversion package, but emphasis currently is on supplying Channel Air Bridge and the entire production effort is aimed toward that end.

Still under development is the loading system. Channel Air Bridge is investigating an electrically-powered lift for cars and palleted freight, and manufacturers in this field have been invited to bid. One problem facing the airline is possible diversion, due to weather, to another airport lacking this equipment, and some thought is being given to carrying an internal ramp aboard, or spotting lifts at selected diversionary airports.

Also being considered for the future is a long-range Carvair version, capable of airlifting rockets to the Woomera Rocket Range in Australia.

One indication of interest in the Carvair, and its new routes to Switzerland, is the fact that Channel Air Bridge has received a number of unsolicited bookings for April and May, 1962, without yet having started an advertising campaign.

The Carvair can haul five medium-sized, or six small cars, plus motorcycles, and up to 23 passengers. License also allows Channel Air Bridge to haul freight and up to eight supplementary passengers (those not accompanying a car).

Passenger fares to Geneva and return will be about $84. Price for a vehicle, about 11 ft. long, from London to Geneva will be about $24.

Channel Air Bridge said its passenger surveys indicate that passengers are willing to pay a higher fare to fly their cars deeper into the Continent. But the airline noted that there is a "vulnerability" in the service from the competition of a projected tunnel or bridge over the English Channel and the development of the hovercraft type of vehicle. Thus, plans have been promulgated on extension and development of the business which it has developed since 1954.

As of June 30, Channel Air Bridge had carried 434,127 passengers and 93,601 cars, starting in 1954. Freight has amounted to 20,913 tons. This year, the airline estimates its passenger traffic between Southend, Calais, Ostend and Rotterdam at 145,000, in addition to hauling 35,000 cars.

The airline said Carvair conversion costs about $294,000. The converted airplane will sell for about $520,000; price includes re-sealing of fuel tanks and zero-time engines and propellers, but does not include furnishings and radios.

# Aeroflot Urged to Raise Efficiency So Transportation Costs Will Drop

**Moscow**—Aeroflot's operation is growing increasingly more profitable, according to Soviet bookkeeping—but the Soviet airline is being pressured to increase efficiency and thereby lower air transportation costs. Ekonomicheskaya Gazeta, organ of the Central Committee of the Communist Party, carried an article signed "Observer" which among other things said "productivity" of turbine aircraft so far is lower than conventional models. Jet and turboprop aircraft can fly more hours per year than other planes, but this advantage is not being realized by Aeroflot.

For example the Tu-104, the article continued, spends an average of 70 to 75% of its time on the ground on voyages with three intermediate landings, and only 25 to 30% in the air.

The situation will improve as aircraft with greater range and speed join the fleet, according to the article. The Tu-114, for example, can fly nonstop to such cities as New York and Rangoon at speeds of 800 kph., the Soviet economic newspaper said. However, this won't solve all problems, the newspaper added.

Last year amortization costs—which apparently include overhaul and major maintenance in the Soviet system—accounted for one-fourth the total costs of all departments of Aeroflot. (It is widely assumed, observers note, that Aeroflot makes its profit partly because it obtains aircraft at artificially low prices.)

Ekonomicheskaya Gazeta says high equipment expenditures for turbine aircraft result from complexity and large weight. But it notes also that the French Caravelle manages to do the same work as the Tu-104A at a lighter weight.

However, according to the Soviet newspaper critic, the main opportunity for reduction of costs lies in increasing the time between overhaul of airframe and engines. If the time between major maintenance could be doubled, this alone would reduce costs of air transportation by 15-20%, it is calculated.

Better jet fueling system also would reduce idle time, says Ekonomicheskaya Gazeta. Special stationary fueling units, fed by pipelines, would bring great economic savings. Mechanization of loading and unloading cargo also needs to be increased, the newspaper said. An existing automatic conveyor could load a whole ton of freight on a Tu-104 in one minute—but cannot operate at capacity because the 104's doors are too small and there is no mechanized system inside the plane. Freight compartments also were described as too small.

Government planning authorities are urged by Ekonomicheskaya Gazeta to consider the creation of a special cargo aircraft to increase the utilization of air transportation in freight movement. Observers note that Soviet policy has been to encourage the air movement of passengers, but to leave freight to rail and water transport except in special cases.

The newspaper also said: "It is profitable to haul freight by air to those districts where there are insufficient or nonexistent rail facilities, waterways or highways and where freight circulation is not great. The necessity for wider application of air freight transportation is dictated by the fact that . . . [some] enterprises often require urgent delivery of materials, automatic controls, instruments, etc. An increase of air freight transportation would promote an increase in payloads of aircraft, bring a reduction in freight costs" and relax pressure on overcrowded rail facilities.

The Aeroflot article predicted that future reductions of some 10 to 15% annually will make it possible by 1965 to reduce the cost of any air passenger ticket to the same level as "hard seat" railway compartments.

Despite complaints about inefficiency and high costs, the newspaper said that air transportation costs—although still high—will be reduced by 35 to 40% in the course of the Seven-Year Plan. The article noted that turbine-powered aircraft will carry 90% of all passengers by the end of the Seven-Year Plan.

## DC-8 Sets Record

**Los Angeles—Supersonic flight was achieved recently in a dive by a Douglas DC-8 during tests of a new extended leading-edge wing. Fact that the airliner flew faster than Mach 1 was confirmed after reduction of the data taken aboard the aircraft and that recorded by ground tracking devices.**

**On the flight, the DC-8 climbed to 50,000 ft. while carrying the equivalent of its normal payload. The jet transport slightly bettered the speed of sound diving through 40,350 ft.—660 mph. at that altitude.**

**The DC-8 was flown by Douglas' Chief Engineering Test Pilot William M. Magruder and Engineering Test Pilot Paul H. Patten. The high-speed flight was part of the test program conducted on the new 4% wing, so called because of its new leading edge contour which also adds 4% more area to the wing.**

# Airline Income and Expenses—June, 1961

(IN DOLLARS)

| | Passenger Revenue | U. S. Mail | Express | Freight | Charter | Total Operating Revenue | Total Operating Expenses | Net Income Before Taxes |
|---|---|---|---|---|---|---|---|---|
| **DOMESTIC TRUNKS** | | | | | | | | |
| American | 36,030,305 | 669,724 | 370,148 | 2,225,970 | .......... | 39,744,221 | 34,808,793 | 4,935,428 |
| Braniff | 6,292,076 | 165,366 | 69,657 | 233,195 | 38,926 | 6,889,067 | 6,131,726 | 619,128 |
| Continental | 5,334,000 | 87,000 | 42,000 | 147,000 | .......... | 5,683,000 | 4,951,000 | 521,000 |
| Delta | 12,708,000 | 234,000 | 133,000 | 413,000 | 57,000[2] | 13,749,000 | 12,138,000 | 1,407,000 |
| Eastern | 20,949,476 | 439,311 | ........ | 1,070,739[4] | .......... | 22,614,498 | 23,881,014 | −1,295,393 |
| National | 5,591,502 | 118,851 | 25,816 | 220,982 | 154,332 | 6,264,450 | 5,891,603 | 149,570 |
| Northeast | 4,130,029 | 57,914 | 26,017 | 85,338 | 45,098 | 4,390,853 | 4,772,927 | −382,074 |
| Northwest | 7,432,561 | 182,879 | ........ | 424,591[4] | 10,201 | 8,259,384 | 6,580,667 | 1,476,460 |
| Trans World | 24,521,879 | 483,437 | ........ | 1,478,445[4] | 140,920 | 27,000,036 | 25,760,574 | 306,344 |
| United[1] | 48,412,000 | 1,460,000 | 535,000 | 2,081,000 | 199,000 | 52,687,000 | 46,120,000 | 6,161,000 |
| Western | 5,371,702 | 99,159 | ........ | 202,500[4] | 97,187 | 5,794,335 | 5,225,264 | 371,693 |
| **INTERNATIONAL** | | | | | | | | |
| American | 413,988 | 7,170 | ........ | 67,600 | .......... | 516,901 | 549,049 | −32,148 |
| Braniff | 836,478 | 41,755 | ........ | 68,881 | .......... | 1,002,787 | 1,073,047 | 92,504 |
| Caribbean Atlantic | 275,950 | 3,129 | ........ | 16,762[4] | 4,704 | 307,181 | 296,103 | 11,799 |
| Delta | 155,000 | 1,000 | ........ | 4,000 | .......... | 167,000 | 230,000 | −169,000 |
| Eastern | 2,884,932 | 64,227 | ........ | 156,680[4] | .......... | 3,107,505 | 2,994,889 | 73,926 |
| Mackey | 138,951 | .......... | 991 | 3,258 | 4,862 | 158,496 | 151,772 | 5,028[3] |
| Northwest | 3,010,641 | 693,103 | ........ | 332,399 | 48,541 | 4,237,939 | 2,817,074 | 1,305,630 |
| Pan American Combined | 34,691,000 | 2,521,000 | ........ | 3,734,000[4] | 1,582,000 | 43,848,000 | 39,037,000 | 2,250,000 |
| Alaska | 520,000 | 21,000 | ........ | 53,000[4] | .......... | 599,000 | 519,000 | −21,000 |
| Atlantic | 17,764,000 | 1,152,000 | ........ | 1,545,000[4] | 681,000 | 21,530,000 | 19,138,000 | 1,982,000 |
| Latin America | 7,758,000 | 229,000 | ........ | 1,049,000[4] | 268,000 | 9,906,000 | 9,847,000 | 742,000 |
| Pacific | 8,649,000 | 1,119,000 | ........ | 1,089,000[4] | 633,000 | 11,798,000 | 9,530,000 | 627,000 |
| Panagra | 1,253,000 | 63,000 | ........ | 240,000 | 15,000 | 1,776,000 | 1,817,000 | −74,000 |
| South Pacific | 39,762 | 242 | ........ | 1,921[4] | .......... | 42,683 | 136,907 | −102,610 |
| Trans World | 7,767,013 | 691,230 | ........ | 633,358[4] | 163,445 | 9,493,049 | 8,204,339 | 1,007,853 |
| Western | 473,101 | 5,238 | ........ | 13,701[4] | .......... | 494,813 | 489,183 | −9,454 |
| **LOCAL SERVICE** | | | | | | | | |
| Allegheny | 1,323,489 | 22,294 | 21,090 | 40,094 | 8,147[2] | 1,945,411 | 1,764,338 | 125,504[3] |
| Bonanza | 449,049 | 3,998 | 2,046 | 7,977 | 1,361 | 753,000 | 668,208 | 64,423 |
| Central | 337,493 | 11,677 | 5,120 | 14,001 | 1,827 | 739,525 | 654,502 | 81,288[3] |
| Frontier | 647,919 | 15,882 | 5,332 | 28,621 | 307 | 1,405,131 | 1,205,738 | 188,812 |
| Lake Central | 565,065 | 9,812 | 19,316 | 10,714 | 710 | 967,891 | 900,439 | 57,076[3] |
| Mohawk | 1,178,040 | 14,346 | 15,063 | 20,765 | 22,005 | 1,688,427 | 1,399,133 | 174,582[3] |
| North Central | 1,560,873 | 34,989 | 24,500 | 38,920 | 1,876[2] | 2,405,186 | 2,052,509 | 331,9 8 |
| Ozark | 771,693 | 16,376 | 18,011 | 25,565 | 8,030 | 1,091,763 | 1,116,776 | −35,605 |
| Pacific | 572,043 | 16,822 | 3,600 | 9,256 | 57,282 | 993,801 | 873,133 | 102,627 |
| Piedmont | 816,865 | 11,371 | 8,859 | 14,553 | 22,168[2] | 1,279,506 | 1,117,972 | 137,538 |
| Southern | 517,101 | 17,350 | 5,640 | 17,643 | 3,571 | 931,401 | 822,876 | 100,179 |
| Trans-Texas | 483,423 | 14,879 | 4,943 | 20,839 | 28,263 | 906,638 | 868,588 | 37,989 |
| West Coast | 608,276 | 8,943 | 3,708 | 14,934 | 1,694 | 1,040,116 | 892,237 | 128,626 |
| **HAWAIIAN Lines** | | | | | | | | |
| Aloha | 451,564 | 1,936 | ........ | 5,639 | .......... | 524,585 | 498,080 | 1,599[3] |
| Hawaiian | 653,377 | 3,421 | ........ | 79,251 | .......... | 787,756 | 679,646 | 89,321 |
| **CARGO LINES** | | | | | | | | |
| Seaboard World | 391,644[6] | 392,354 | ........ | 664,879 | 78,928[7] | 535,543 | 2,056,330 | −547,435 |
| Slick | .......... | .......... | ........ | .......... | .......... | 855,720 | 725,196 | 100,788 |
| **HELICOPTER LINES** | | | | | | | | |
| Chicago Helicopter | 138,683 | 131,514 | ........ | .......... | .......... | 270,210 | 281,841 | −11,676 |
| Los Angeles Airways | 26,666 | 12,838 | 12,503 | .......... | .......... | 141,270 | 136,029 | 6,244 |
| New York Airways | 103,848 | 3,701 | 2,746 | 4,175 | .......... | 313,233 | 349,483 | −38,237 |
| **ALASKA LINES** | | | | | | | | |
| Alaska Airlines | 223,400 | 41,429 | 1,247 | 51,756 | 272,741 | 832,128 | 779,069 | 54,805 |
| Alaska Coastal | 106,020 | 9,385 | ........ | 11,524 | 5,326 | 189,460 | 184,945 | 2,459[3] |
| Cordova | 26,420 | 8,052 | ........ | 20,766 | 146 | 122,361 | 140,067 | −18,246 |
| Ellis | 75,500 | 4,700 | ........ | 8,400[4] | 1,500 | 124,200 | 91,500 | 32,300[3] |
| Kodiak | 22,903 | 469 | ........ | 2,600 | 12,705 | 42,115 | 38,633 | 2,869[3] |
| Northern Consolidated | 155,638 | 60,677 | ........ | 69,714 | 23,167[2] | 398,390 | 349,375 | 15,965[3] |
| Pacific Northern | 942,827 | 83,367 | 2,960 | 133,948 | 155 | 1,290,359 | 1,089,469 | 199,066 |
| Reeve Aleutian | 160,113 | 41,621 | ........ | 52,372[5] | 56,496 | 316,298 | 224,755 | 95,912 |
| Western Alaska | 13,611 | 6,260 | ........ | 1,527[5] | 11,124 | 32,510 | 23,514 | 5,251[3] |
| Wien Alaska | 168,773 | 73,980 | ........ | 53,677 | 65,379 | 462,405 | 410,260 | 46,060[3] |

[1] United's figures include domestic and international income and expenses. [2] Other transportation. [3] Net profit or loss.
[4] Property. [5] Includes excess baggage. [6] Passenger charter. [7] French charter.

**Figures for Trans Caribbean, Flying Tiger and Riddle were not available.**
**Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.**

## SHORTLINES

▶ **Chicago Helicopter Airways,** celebrating 12 yr. of scheduled operation, reported it has flown more than 6.2 million scheduled miles in the period.

▶ **Federal Aviation Agency** has called a conference for Sept. 11 in Washington to discuss revisions to regulations governing performance and operation of turbine-powered aircraft. Those planning to attend should notify FAA before Sept. 5.

▶ **Federal Aviation Agency** has raised the ceiling of the Chicago-Indianapolis positive control area from 35,000 ft. to 60,000 ft. The new ceiling will give protection of positive control to high performance civil and military aircraft conducting flight tests and training operations above 35,000 ft. Base altitude will remain at 24,000 ft.

▶ **Japan Air Lines** reports earnings of $5.9 million for July, an increase of $347,425 over the preceding month.

▶ **Lake Central Airlines** will serve Martinsburg, W. Va., on its Washington, D. C. to Charleston, W. Va., and Cincinnati-Washington/Baltimore routes, beginning Oct. 29.

▶ **Lockheed's JetStar** utility jet transport last week received both type and production certificates from Federal Aviation Agency. The aircraft, powered by four Pratt & Whitney JT12 turbojet engines, carries eight passengers at speeds in excess of 550 mph.

▶ **Northwest Airlines** is converting four of its DC-7Cs to DC-7CF air freighters. First converted aircraft was scheduled for delivery late last month. The others will be delivered in September.

▶ **Panagra** has begun service with Douglas DC-8 turbojet aircraft between New York and Guayaquil, Ecuador. Schedule calls for one round trip per week, leaving New York on Thursday and returning on Monday.

▶ **Trans World Airlines** has asked the Civil Aeronautics Board for permission to sell "open jaw" tickets under the coast-to-coast round-trip excursion rate plan. Under the arrangement, passengers may fly from New York to Los Angeles and return to New York from San Francisco.

▶ **United Air Lines** has repurchased 6 of the 15 Vickers turboprop Viscounts that were returned to the manufacturer when the airline merged with Capital.

## AIRLINE OBSERVER

▶ Watch for Federal Aviation Agency's Project Tightrope report to recommend formation of a "blue-ribbon cadre" of FAA accident investigators who would be rushed to the scene of major airline transport crashes. The recommendation may foreshadow a broader FAA role in accident investigation, now statutorily assigned to Civil Aeronautics Board. Project Tightrope task force is headed by Lloyd N. Cutler, a Washington lawyer, and was created to develop better methods for adopting and enforcing air safety regulations.

**▶ Domestic airline common stocks continued to decline last week, a sluggish condition which has prevailed for the past four weeks. On one occasion last week, American Airlines was the most active issue on the New York Stock Exchange with a turnover of 140,000 shares, although the loss that day was only fractional. Early last week, TWA common stock hit a new 1961 low. Recent lack of investor interest in airline stock is attributed by Wall Street to poor first-half showing of the domestic trunklines.**

▶ Bilateral air transport agreement with the Soviet Union, negotiated and then scrapped last month after the border between East and West Berlin was sealed by the East German Communists, contained a clause in which the Russians agreed in principle to conform with International Civil Aviation Organization technical standards. ICAO, however, was not mentioned. A collateral agreement between Pan American World Airways and Aeroflot, the two carriers selected to fly the Moscow-New York route, listed Gander, Shannon, Oslo and Stockholm as "technical stops." Both carriers were to operate two flights per week between the two capitals, with Aeroflot using only Tupolev Tu-114 and Ilyushin Il-18 turboprop transports, the latter fitted with extra fuel tanks.

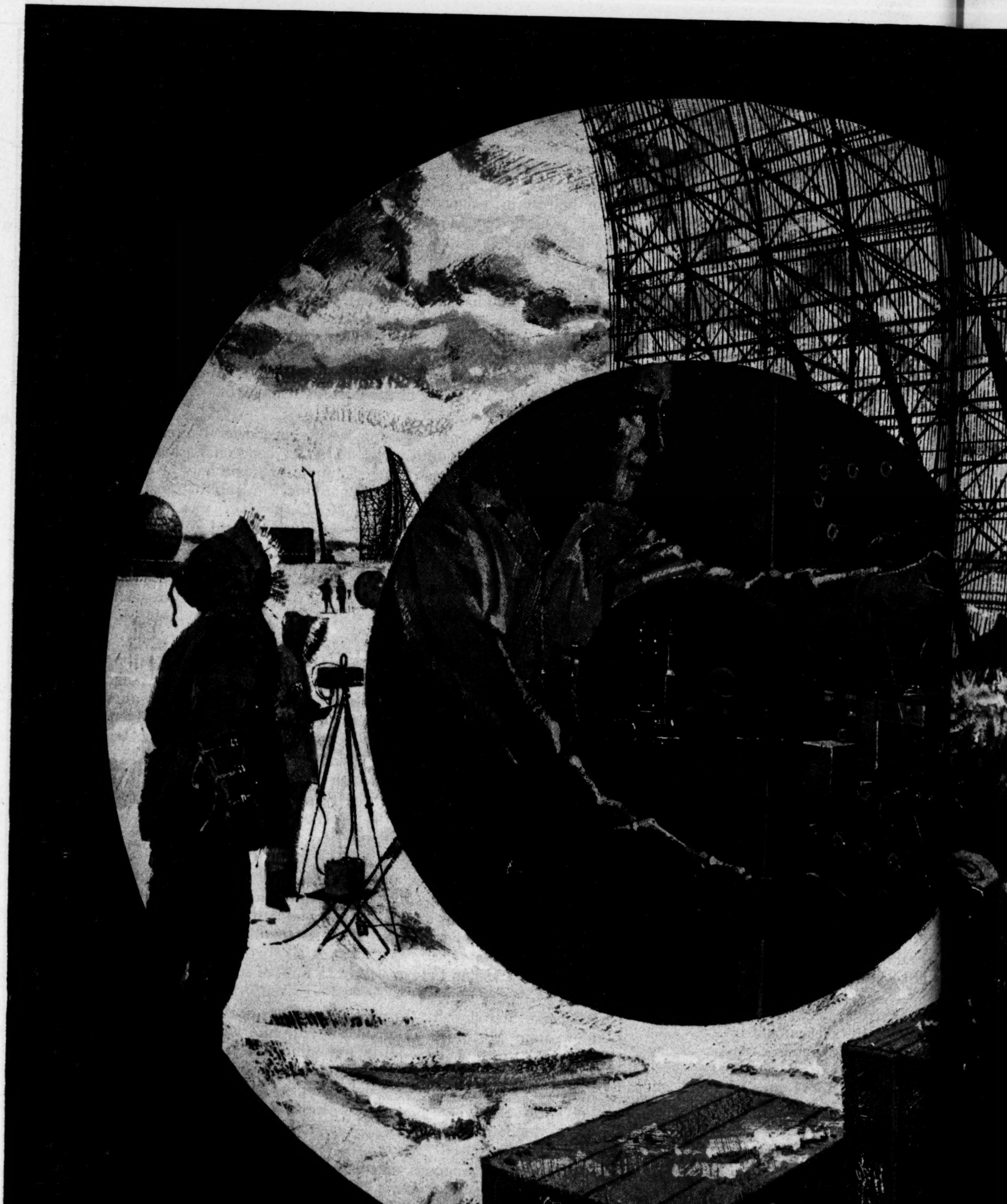
**▶ Flying Tiger Line will purchase five Canadair CL-44 turboprop cargo transports in addition to the 10 it has on order if it can arrange necessary financing. Carrier plans an initial utilization of 10 hr. per aircraft, hopes eventually to attain a goal of 16 hr. Consideration is being given by Flying Tiger President Robert Prescott to using the CL-44 in transatlantic charter service, carrying 219 passengers at a round-trip rate of about $99.**

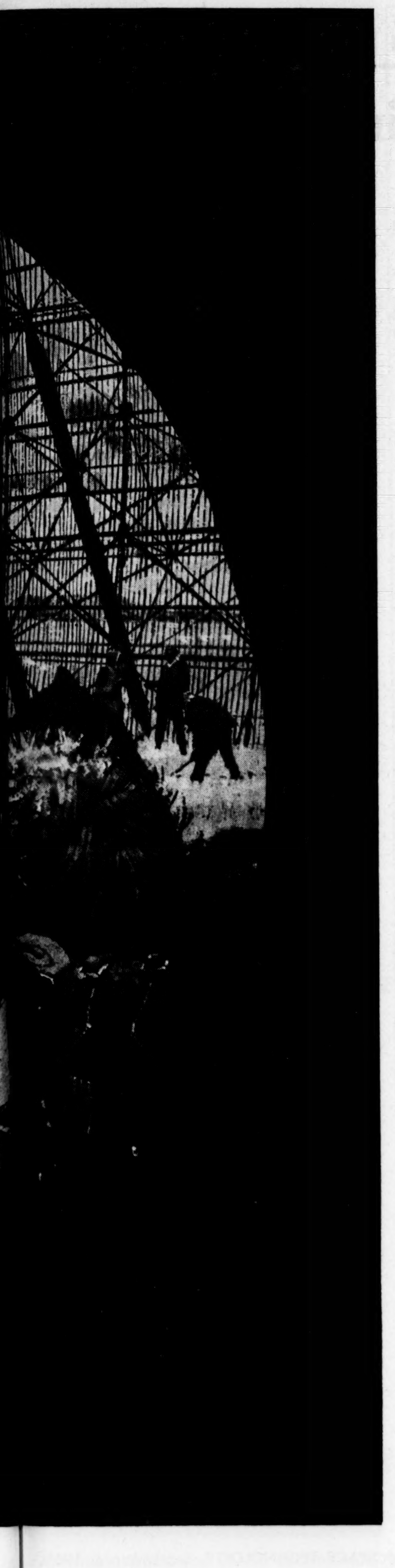
▶ Trans World Airlines has been granted a 200-hr. extension of its time between overhauls to 2,200 hr. on the Pratt & Whitney JT3C-6 turbojet engine.

**▶ Eastern Air Lines has increased its New York-Washington commuter service to provide every-hour-on-the-hour service between 7 a.m. and 10 p.m. By the middle of this month, Eastern will have a total of 23 Lockheed 1049 Constellations converted to 95-seat configuration for this service. Since service began on Apr. 30, 95.8% of all flights have operated exactly on schedule, 98.3% on time or within 15 min. of schedule.**

▶ Russia's Aeroflot has inaugurated regular service over its far northern route from Moscow to Chukotsk in extreme northeastern Siberia via the Laptev Sea port of Tiksi. Il-18 turboprop transports are making one round trip weekly over the line, most of which is above the Arctic Circle. Flying time is 11.5 hr. Moscow-Chukotsk proving runs began last December. Previously, the only main air link with the remote Chukotsk National District was to the South, through Magadan and Khabarovsk.

**▶ Compromise proposals, offered by the Russians to Japan as a first step toward opening an air route between Moscow and Tokyo (AW Aug. 28, p. 52), have again proved fruitless. Transportation Ministry has refused to accept a suggestion by Soviet Deputy Premier Mikoyan that Russia will agree to direct service between Tokyo and Moscow on condition that Soviet pilots man Japanese transports between Khabarovsk and the Russian capital. Explaining this condition, Mikoyan said that, "to be frank, Japan has concluded a military pact with the United States and there is the danger of Japanese airlines taking photographs of Siberia." He also said there is a fear that these pictures might get into U. S. hands.**





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# AERONAUTICAL ENGINEERING

# Rolls Increases Turbine Engine Experience

**London**—Problems with Rolls-Royce commercial gas turbine engines have followed the expected pattern of randomness, varying from the metallurgical phenomenon that delayed the Tyne turboprop to the minor snags of the Avon turbojet.

Currently, no major problem remains unsolved. Rolls-Royce has sent engineering solutions and teams promptly to operators, and fitted fixes into production engines on the line with minimum delays.

### Turbine Engines

The company's gas turbine engines—both civil and military types—have racked up the impressive total of 27 million hr. of flight time. Most of this figure is credited to the early lead of the Dart turboprop in commercial service with the airlines. Current commercial turbojet total times approximate one million hours for the Avons and about one-quarter of that for Conways.

Time between overhauls (TBO) has skyrocketed for each of the engines. When the Dart entered commercial service in 1953, its initial TBO was 400 hr. Current figure is 3,300 hr. The Avon, which started at 1,000 hr. in the Comets in 1958, is now approved by the Air Registration Board for 2,900 hr. and selected engines are being allowed to reach 3,200 hr. as a step toward a further increase in TBO.

The Conway bypass engine, which also began flying at 1,000 hr. TBO, is at 1,700 hr. now, with trials under way to increase this to 1,900 hr.

Bearing and blade problems have been the major difficulties experienced by operators of the Conway bypass engines. During 382,331 hr. in service up to June 30, 1961, over-all rate of power shutdowns in flight for Conway-powered Boeing 707s was one per 9,000 hr. of operation, and the average for all operations was one per 6,000 hr. of operation. Rolls is still reducing DC-8 data and claims current figures are misleading.

About one-third of the shutdowns were traceable to cage or track defects in front and center bearings. Metal particles collected in the oil filters and were detected, showing incipient bearing failure, before the total failure could occur. Worst offender was the front low-pressure compressor bearing, where the bearing tracks spun and led to failure of the cage. A modification to the bearing housing solved the problem.

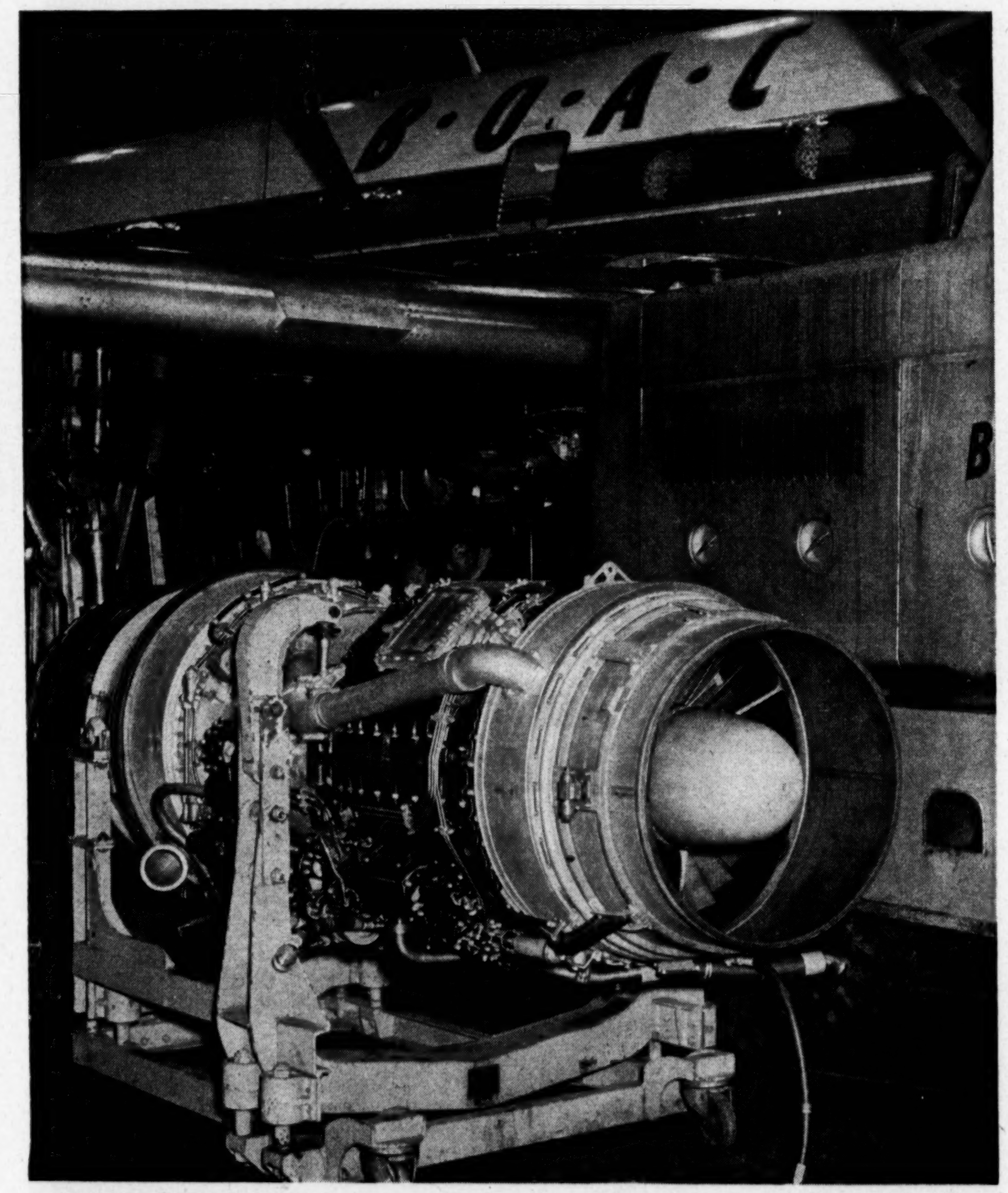
### Center Bearing

In the case of the center bearing, hammering by the rollers of the bearing fatigued the cage. This defect was associated with the cages from one manufacturer only, and has been cured by making cages to a single specification.

Rolls says two recurring incidents involved compressor blading failures in two sections of the high-pressure compressor. First-stage blades experienced resonance due to stalling induced by the aerodynamics of the low-speed regime after prolonged ground running in idling or taxi rpm. Fix was to change the natural frequency of the blade.

More serious problem affected the fifth, sixth and seventh stages of the high-pressure compressor. Only the outboard powerplants of Douglas DC-8 aircraft were troubled, and this clue led to the fix. The trouble started during full thrust-reversing on the ground, when the outboard engines ingested the exhaust gases of the inboard powerplants, and then surged badly. The surging caused rapid fatiguing and failure of the compressor blades. This was cured by a procedural change, which restricted reverse thrust to idle only on the outboard engines except in emergencies.

As of last June 30, the Conways' average rate of unscheduled removals per 1,000 hr., using that sum as an index of one, was .36, a drop from the peak reached in October, 1960, of .48. This compares with the Dart average rate of .225. Alitalia, which operates five Conway-powered DC-8s, had an unscheduled removal rate of .21, per 1,000 hr. As of last May, Trans-Canada operators



**ROLLS-ROYCE AVON RA.29** turbojet is currently certificated by the Air Registration Board for 2,900-hr. TBO in de Havilland Comet IVB and C models.

of 10 DC-8s powered by Conways, had a somewhat higher rate; as of last April, it was .59 per 1,000 hr., a drop from the peak of .79 recorded last December. Operators using Conway-powered 707s have achieved a rate of just under .10.

Rolls said that between April, 1960, and June, 1961, there were 75 unscheduled removals of Conways flown a total of 245,448 hr. Six involved failure of the low-pressure compressor front bearing and since the fix, increasing clearance of the housing, there have been no removals for this reason. In the case of center bearing failures, which involved nine engines, there have been no failures since the modification.

### Nimonic 105

On 13 engines removed because of difficulties with high-pressure turbine blades, the fix was replacement of Nimonic 95 blades at overhaul with Nimonic 105, and all new engines now are being built with the latter alloy. As of June 30, a total of 12,223 hr. has been flown by Nimonic 105 and there have been no failures.

Removals of 10 engines were attributed to the high-pressure compressor blade and Rolls suggested that operators limit amount of running time in the 5,000 to 7,000 rpm. range, and began modifying the blade angles. There has been one removal in a three-month period prior to June since this practice started.

In the case of troubles with the fifth stage compressor blade, with nine removals blamed on that section, the fix was to increase the clearance between the rotor and stator. There have been two removals since the fix was ordered, but no failures of engines with modified clearances have occurred.

Oil consumption was another trouble area, since the specification allows only 0.9 of a pint as the consumption rate. There were nine removals of engines which exceeded this factor and to fix it, Rolls altered seal clearances. Engineers are making checks on test stands at specific rpm. ranges, and a new seal is under development testing. There has been one removal since the seal clearance was changed.

### Varied Problems

In 20 other unscheduled removals, the problems were varied. For instance, three were due to center bearing spin, another three to fouling of the low-pressure compressor blading, and three more due to vane ingestion. Other failures included a zero stage breakaway, failure of the internal wheelcase and the wheelcase drive, and in one case, an imbalanced condition.

First 200,000 hr. of Avon engine flight time were not marred by a single in-flight shutdown due to engine failure.

## Trans-Canada Conway Experience

**Trans-Canada Air Lines, one of the major users of the Rolls-Royce Conway bypass engine, pointed out some additional troubles experienced with that engine in a report submitted to the Society of Automotive Engineers by J. F. Dyment and J. J. Eden of the airline. TCA points out that it entered the program early. By buying an engine that had not accumulated substantial running time prior to airline operations—during the first month of commercial operations Conways ran more hours than during their entire development history—TCA also had bought an initial operational development period.**

**The company took the risk because of its previous experience with Rolls-Royce, trusting in the ability of the engine company to analyze rapidly component problems and to make the necessary fixes quickly.**

**TCA now feels that the Conway is over the hump and will gradually approach the Dart in reliability.**

**The Canadian airline outlined these problems:**

- **Front bearing housing vanes cracked due to vane resonance; the cracks were aggravated by anti-icing air at 70 psi. and 300C (572F). To remedy this, Rolls is filling the susceptible portion with rubber while keeping the leading and trailing edges of the vane clear for anti-icing air.**
- **Turbine blades showed large scatter in reliability. These Nimonic 95 high-pressure turbine blades showed four failures below 1,000-hr. time on the engine. TCA says that initially its DC-8s used takeoff power for two minutes, but that noise-abatement routines reduced this time to less than one minute generally. The airline credits this revised procedure with relieving the blade situation, and says the air-cooled turbine blade will not even stabilize at the gas temperature during such a short takeoff power usage. TCA is replacing those blades with ones made of Nimonic 105, which the airline says are known to give substantially better operation than the Nimonic 95 blades in Dart operation.**
- **High-pressure sixth-stage compressor blades failed on the outboard nacelles of the DC-8s just as with other operators.**

**TCA calls itself "fortunate" in having only one high-pressure compressor first-stage blade failure, compared with other operators. They attribute the failure to resonance in taxiing and idling regimes, and say that operating restrictions in these areas have been imposed to make a temporary fix. Modifications will remove the limitations.**

- **Low-pressure compressor front bearing problems caused 11 engine removals during the first year of TCA operations. Modifications have cured the problem, the airline says.**
- **Fuel pump failures caused eight unscheduled engine removals during TCA's first year. In addition, TCA campaigned all fuel pumps which had not been inspected by its own shop. The airline said that a severe drop-off was found in the pump manufacturer's inspection quality and techniques. Urgent steps have been taken by the manufacturer, plus a modification program to get the pumps right. TCA says the fuel pump is hidden by numerous rigid pipes difficult to remove, and access to it is made difficult by a projection of the lower panel of the nose cowl which hides work on the pump from view. Rather than change the pump in the face of these difficulties, TCA prefers to pull the whole engine for a fuel pump change. TCA takes 5½ hr. for a normal powerplant change, including the ground run; it takes almost as long to change a fuel pump on the installed engine.**

Rolls reports only two non-random snags since that time. The first was in the front bearing housing which cracked under complex loading, and was fixed by a modification which shifted its natural frequency. The second problem was with deterioration of oil seals in the gearbox shroud and was easily solved, presumably by a material change.

Out of a total of 1,066,142 hr. of civil operation as of June 30, there have been 45 power shutdowns. For Caravelles, there have been 12 shutdowns.

Unscheduled removal rate for both airplanes is about one per 3,000 hr. Rolls said there have been no major problems in higher rated Avons powering Alitalia and Sabena Caravelles, equipped with the 12,200-lb. thrust Mk. 531, or United Caravelle Mk. 532, also of 12,200-lb. thrust.

About a year ago, a Tyne turbine disk burst during static testing at a time when the Vickers Vanguard, powered by four Tynes, was just about to be certificated. Follow-up inspection of every Tyne that had flown showed only one other disk in bad shape; it had a crack radiating out from the bore.

The problem was an obscure one, and finally was tracked down to statistical variation of the physical properties of the material. The same analysis predicted that only one out of every 200 disks would probably be faulty, but Rolls decided to scrap 3,500 disks made

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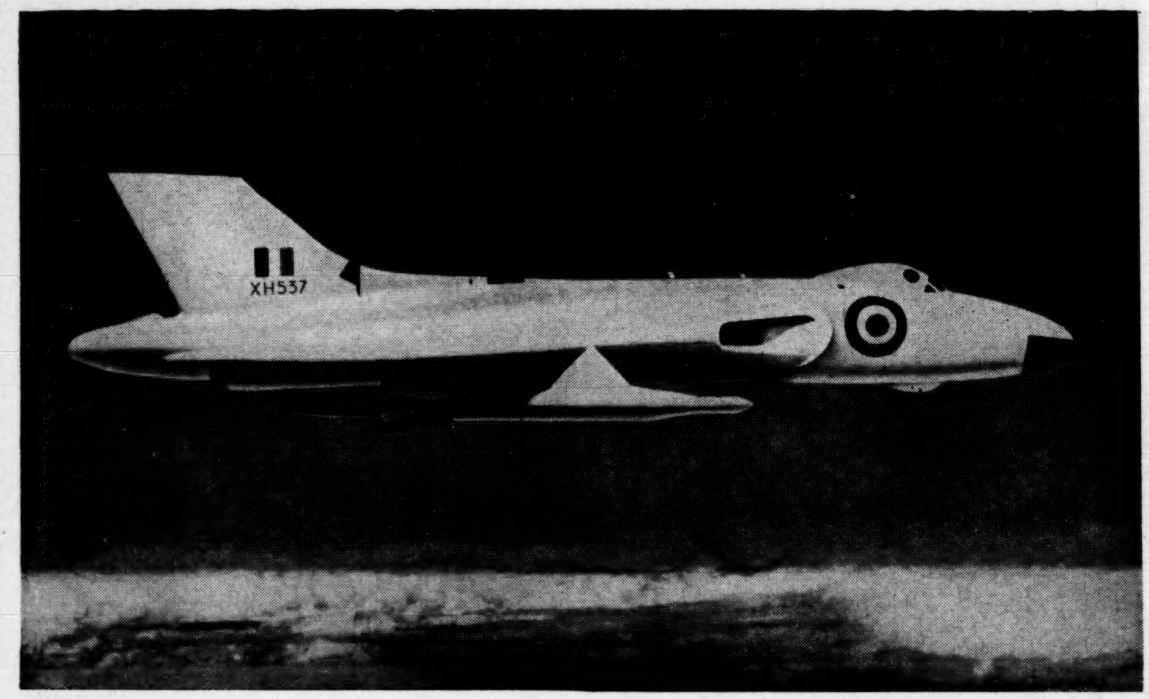

**Vulcan Undergoing Skybolt Compatibility Tests**

**Artist's conception of Avro Vulcan B Mk. 2 bomber for Royal Air Force shows underwing fitting and early Douglas Skybolt air-to-surface missile, which will be attached to a wing pylon. Vulcan is undergoing Skybolt compatibility tests in the U. S. Conversion unit for missile computer system is being developed in the U. K. by Associated Electrical Industries.**

for the turbines and the last two stages of the high-pressure compressor.

Changing the manufacturing process eliminated the chance of uncontrolled physical properties taking over and creating a dangerous situation.

Disk profile and material have been kept in the new approach, but the stock quality is controlled by vacuum melting, and the length-diameter ratio of the billet has been increased so that reducing it during forging results in more hot-working of the material. This in turn improves grain flow (AW Jan. 30, p. 37).

Tyne overhaul time is still 400 hr. —the same as it was when it entered service. Three major fixes have been made and British European Airways' engines now are being trialed at 600 hr. and Trans-Canada at 750 hr. Rolls engineers said the TBO rate should be 1,000 hr. early next year, and 1,200 hr. by the end of 1962.

Aside from the disk failures, which Rolls says cost six months in what would have been normal proving time, the major problem has been in failure of the tail bearing at the aft end of the coupling shaft in the low-pressure section, after excessive vibration. Rolls is improving the engines balance characteristics on the production line, but basic fix was to redesign the tail bearing.

This resulted in a "clutch" type bearing in which the mount allows the bearing to move against its outer race, spring-loaded sintered metal plate. Rotation is around the center of gravity of the shaft rather than its geometric center, and vibration damping has been considerable, the engineers said.

Another problem area was the bearing in the high-pressure sections, where corners of the race tended to dig into moving parts. Radius at the corners has been smoothed to eliminate this trouble. Bearing bugs accounted for 50% of the unscheduled removals but Rolls said this has dropped to 10% since the fixes.

Oil consumption higher than the specification of one pint per hour, the same as the Dart, was another problem plaguing the Tyne. Rolls discovered that the piston-ring type of oil seal used in the high-pressure section was not successful and has since changed it to a thread-seal on all engines.

### Shrouding Pieces

Shrouding pieces around the first stage rotor blades had a history of cracking and Rolls fixed this by beefing up the shrouding itself.

Another important reason for operator troubles with the Tyne is the low life of the Tynes' flame tubes, now set at 350 hr. Carbon buildup on the nose was distorting the flame pattern, and Rolls now is washing the nose with fuel, rather than with air as before. Flame also was burning the tube edges so Rolls turned to a solid cast in that section. Flame tubes now going on all production engines have had the metal gage beefed up and the air holes are being modified.

On Tynes with the bearing fixes, 46 now are in service (18 with TCA) and they have flown 7,500 hr. with no bearing failures. Rolls flew 450 hr. of tests on the tail bearing alone, often up to 18 hr. per day before making the final change.

Company said it is up to program on delivery of Tynes, and ahead on delivery of spares. In the event an operator finds it necessary, Rolls says it now can loan engines where needed.

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The small aluminum globe in the picture is a bomblet Alcoa engineered and developed for the U. S. Army Chemical Corps. The tall tubes to the right are Zuni missile outer shells. The pieces that resemble chess rooks are center sections of the Air Force's Bullpup missile. The drums are chemical shipping and storage containers for the armed forces. The cylinders on the left are ammunition rack tubes for Army Ordnance's M-60 tank.

Not shown are rocket engine cases, flotation spheres, jet fuel filter-separators and scores of other defense items Alcoa turns out by the thousands.

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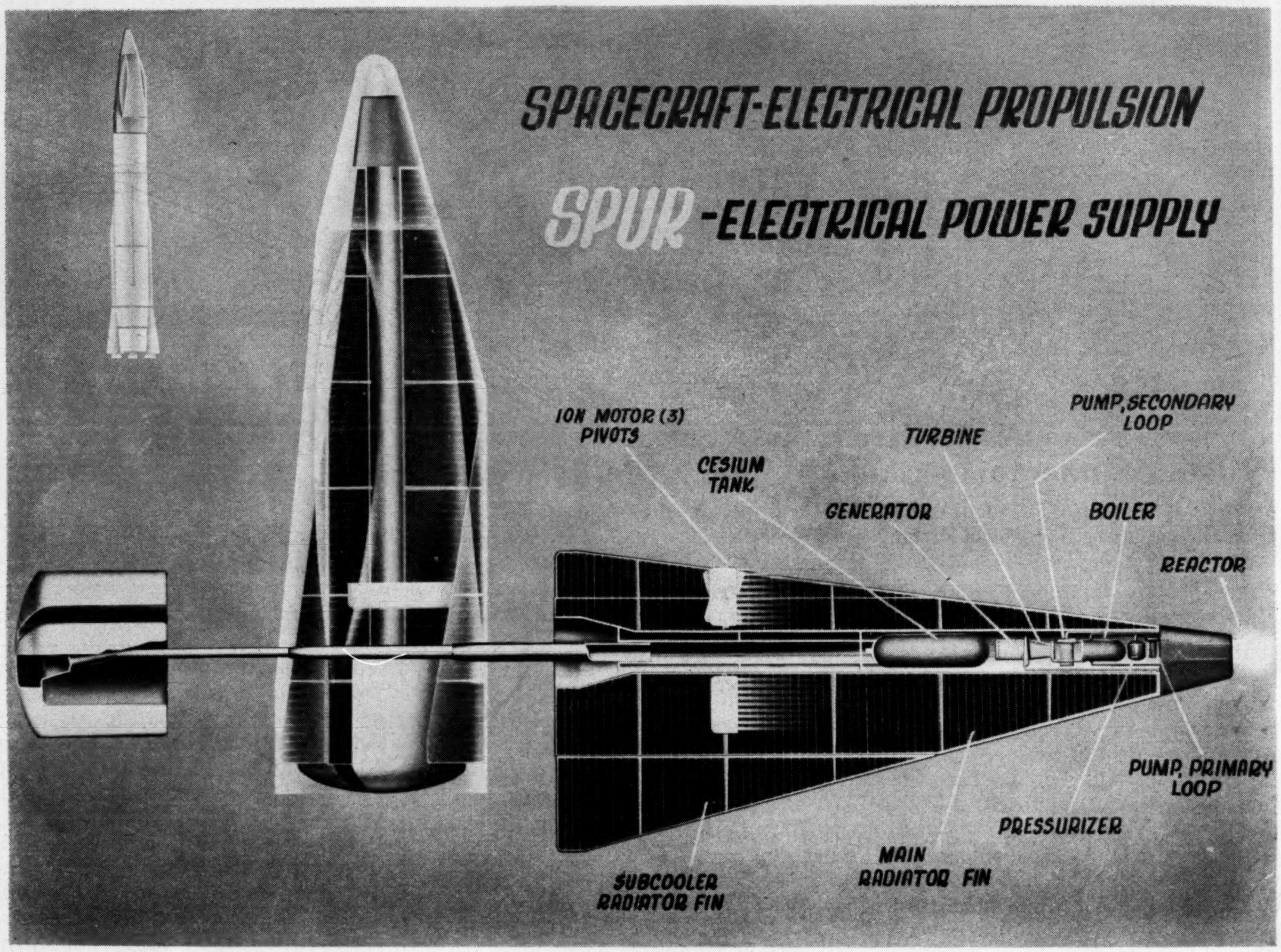
# EQUIPMENT


SPACECRAFT-ELECTRICAL PROPULSION
SPUR -ELECTRICAL POWER SUPPLY
ION MOTOR (3) PIVOTS
CESIUM TANK
GENERATOR
TURBINE
PUMP, SECONDARY LOOP
BOILER
REACTOR
PUMP, PRIMARY LOOP
PRESSURIZER
MAIN RADIATOR FIN
SUBCOOLER RADIATOR FIN

**DESIGN** of the proposed Spur space power system in an electric rocket motor propelled spacecraft shows the shadow-shielded nuclear reactor at right, the two-stage energy conversion circuit and the turbogenerator. Near the middle of the tubular body is the tank of cesium fuel for the ion motors. The vertical view shows the tub-shaped payload capsule retracted, the subcooler radiator fins folded to fit inside a fairing, and the reactor capped. In the horizontal view the payload is extended, fins spread and the reactor and ion motors operating.

# Spur Nuclear Space Powerplant Proposed

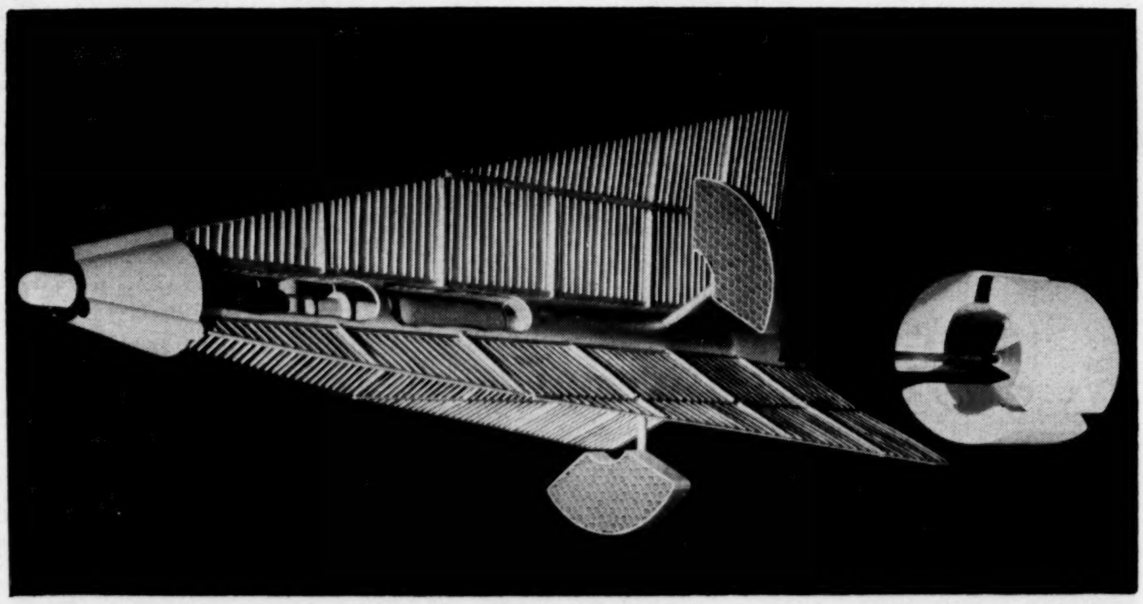
### By Russell Hawkes

USAF study of Spur (space power unit reactor) nuclear turbo-electric powerplant for spacecraft now drawing to a close indicates that the 300-kw. unit could be ready for prototype tests by early 1966 if the government will invest about $50 million in the project over the five-year period.

Spur has a 1,000-kw. (one megawatt) potential. The 300-kw. version has application for space missions planned in 1970 or earlier.

USAF, with the cooperation of the Atomic Energy Commission, awarded the prime contract for the Spur study to Garrett Corp's AiResearch Division. Earliest studies of the system were funded by USAF in 1958 and 1959. Subcontractors are:

- **Aerojet-General Nucleonics Division**—Fast-neutron reactor design.



**SPUR** model made by Garrett Corp., AiResearch Division shows a tubular body containing the propulsion system components, the turbogenerator and the two-phase alkali metal vapor power conversion loops to drive the turbine. A 300-kw. unit could be ready for prototype tests in 1966, according to a USAF study, and a 1,000-kw. unit is envisoned as an outgrowth of the program. USAF funded earliest system studies in 1958 and 1959.

- **Battelle Memorial Institute**—Fuel and materials.
- **Westinghouse Electric Corp.**—Alternator design.

AiResearch is handling the system dynamics including the pump, boilers, radiators, turbine and vapor condensers. A critical problem is that of boiling liquid alkali metal to make pressurized vapor and then condensing it back to the liquid phase without exceeding the limits set by the physical properties of the materials used.

## Advanced System

The Spur system is supposed to be a generation more advanced than the Snap 8 nuclear turbogenerator. The later technology should give an unshielded Spur a weight-power ratio of 8 lb. per kilowatt and a shielded unit a ratio of 10 lb. per kilowatt. The pioneer Snap 8 will weigh approximately 55 lb. per kilowatt. Radiator area for a 30-60 kw. Snap 8 has been set at 500 sq. ft. while only 700 sq. ft. of tube-fin radiator surface is to be provided for the,300-kw. Spur.

Output of the Spur system is calculated to be in the range needed to make ion motors or other electric rockets practical.

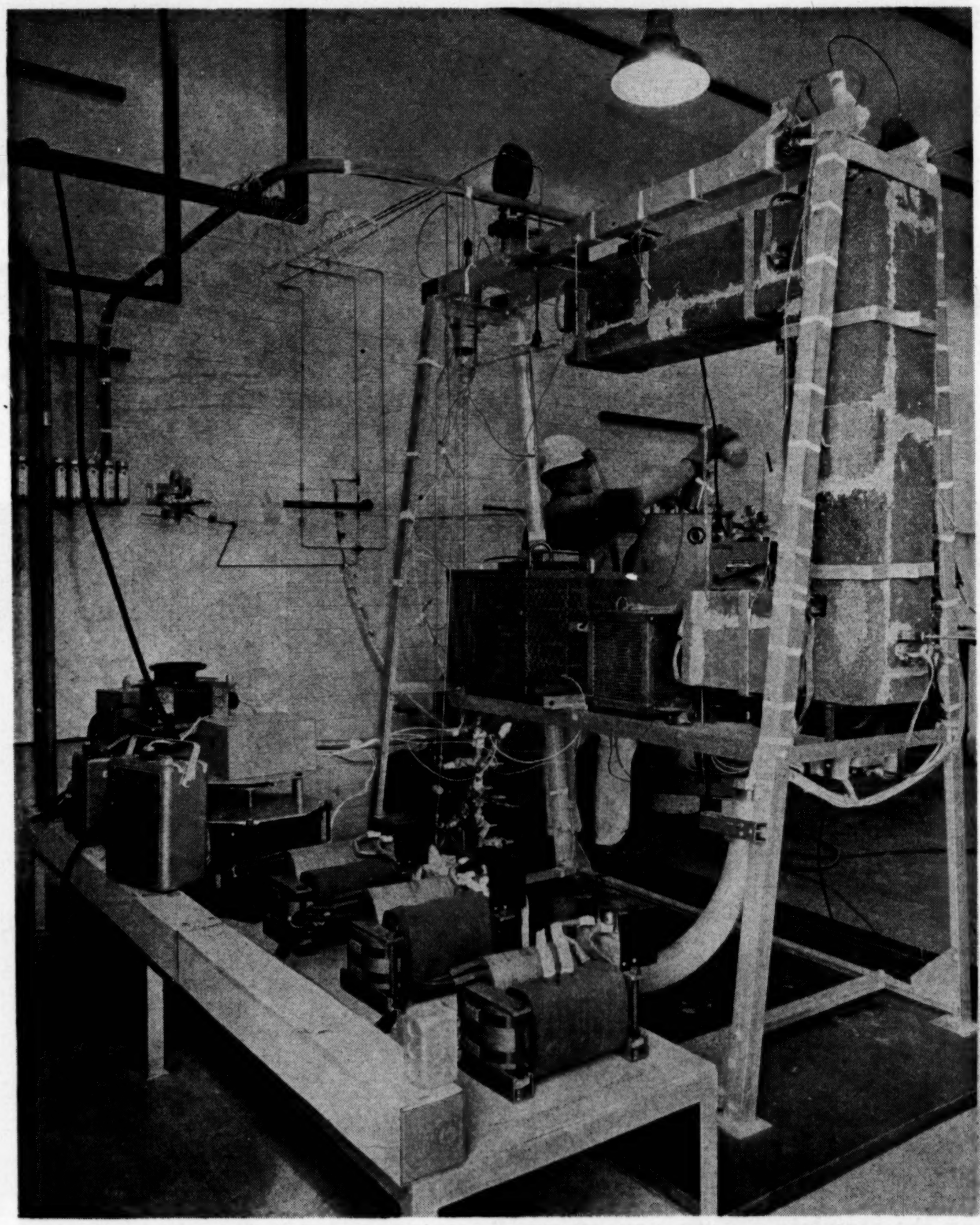
The first 300-kw., three-phase, 110-volt, 320-cps. units are supposed to operate unattended for one year. The 1,000-kw. growth version is to have a two or three year life. As well as being one-sixth the weight of systems designed with earlier Snap technology, Spur linear dimensions should be one-tenth those of the earlier units for a given power output. The sharp reduction in size and weight is made possible by higher operating temperatures which cut radiator area and reduce shielding by making the reactor smaller. Spur is designed for the turbine to be driven at 24,000 rpm. by a fluid at 2,000F while Snap 8 turbine is to be driven by sodium potassium at 1,300F.

To operate at such high temperatures, Spur must use different alkali metals in the two-phase energy transfer system. The first loop carries heat from the reactor to a heat exchanger where the energy is transferred to the fluid in the second loop. The fluid to be used in the first loop has not been announced but the fluid for the second loop will be rubidium, potassium or cesium. After being vaporized at the heat exchanger, it will be expanded through the nozzle to strike the blades of the axial flow Rankine cycle turbine. The initial development tests already performed include evaluations of boiling and condensation of the alkali metals under free-fall conditions and their compatibility with other materials in the system. These are largely refractor metals like tungsten, molybdenum and niobium alloys.

## Stage Dimensions

The Spur system is designed with the stages of the system strung out in a row inside the tubular body of the unit. The reactor is 16.3 in. long and the turbogenerator package is 3 ft. long and weighs 350 lb. Diameter of the tube is 13.5 in. The turbine and generator are expected to achieve a combined efficiency of 70%.

The proposed ion rocket system to propel a Spur vehicle would develop 2-lb. thrust at a specific impulse of 6,000 sec. The propellant tank would hold 2,500 lb. of cesium. Payload of the vehicle would be about 1,000 lb.



**LOOP OF HASTELLOY X** tube is subjected to a 1,000-hr. forced liquid test with potassium hydride flowing at 10 fps. to determine its ability to contain the alkali metal. The test structure is to be enclosed in a box and put aboard a Boeing KC-130 for zero-g tests later. Equipment on the low bench at left is instrumentation.

# PRODUCTION BRIEFING

**Iberia Air Lines'** new jet fleet of three DC-8s will be maintained by Lockheed Aircraft Service-New York, under terms of a contract between the Spanish carrier and the Idlewild facility. This makes the fourth contract awarded to LAS-NY in recent months for maintenance of overseas flag carriers' jets.

**NASA's Marshall Space Flight Center** has awarded two contracts totaling $3,224,183 to International Business Machines Corp., Huntsville, Ala., for rental of electronic gear to compute administrative and scientific data for the Saturn space vehicle project.

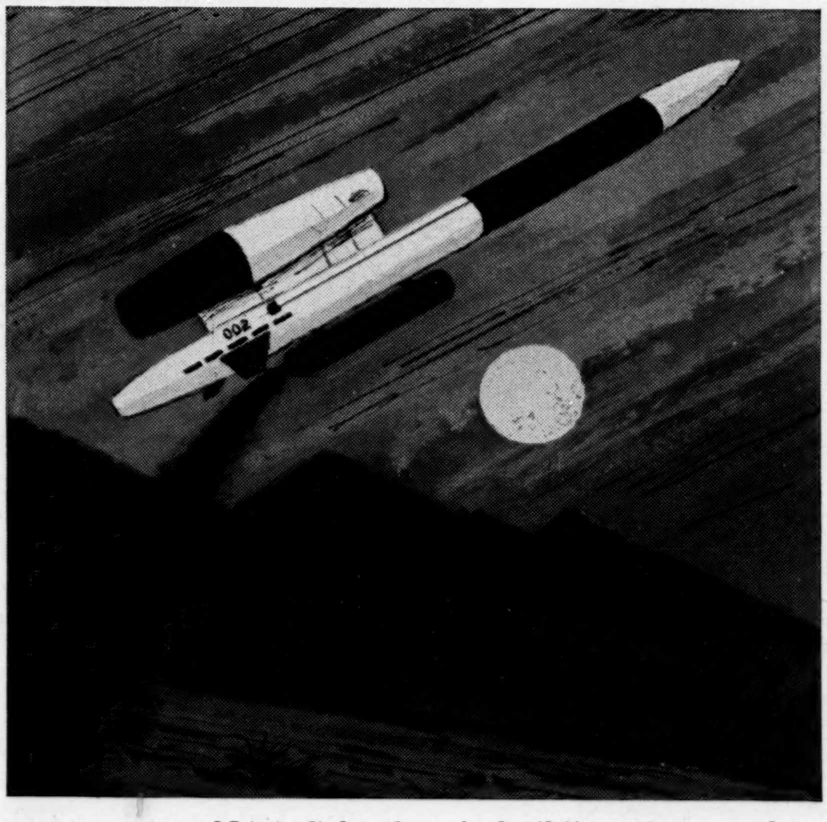
**Gulton Industries, Inc.**, of Metuchen, N. J., has received contracts totaling $427,000 from Grumman Aircraft Engineering Corp., for primary power and power conversion systems for NASA's Orbiting Astronomical Observatory (OAO) program. Grumman is prime contractor and systems manager for OAO, which is expected to orbit at least six months and perform above-atmosphere astronomical experiments.

**New Hawker Siddeley Industries, Ltd.**, division, Hawker Siddeley Engineering, has been formed to undertake design and construction of various proj-

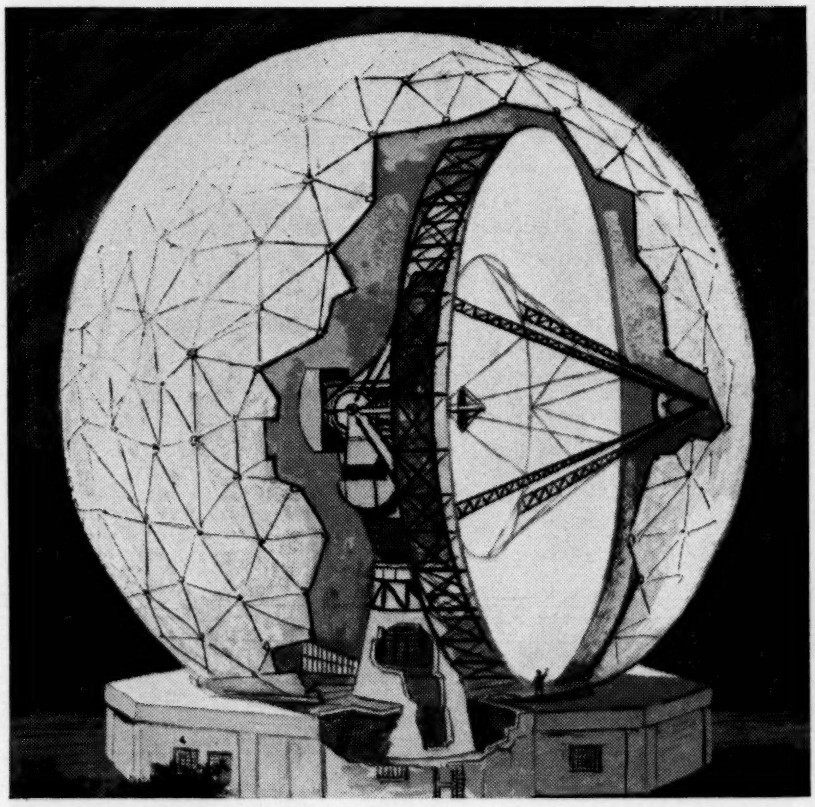
# This is systems capability a

Many of the significant advances in electromechanics, electronics systems, environment systems, and other areas, were originated and brought to fruition at the Columbus Division of North American Aviation. A complete center of advanced systems technology, the Columbus Division has the minds and facilities to convert original concepts into practical hardware with economy and efficiency. This is true systems capability... this is the Columbus Division.

**COLUMBUS DIVISION OF**
**NORTH AMERICAN AVIATION**
Columbus, Ohio

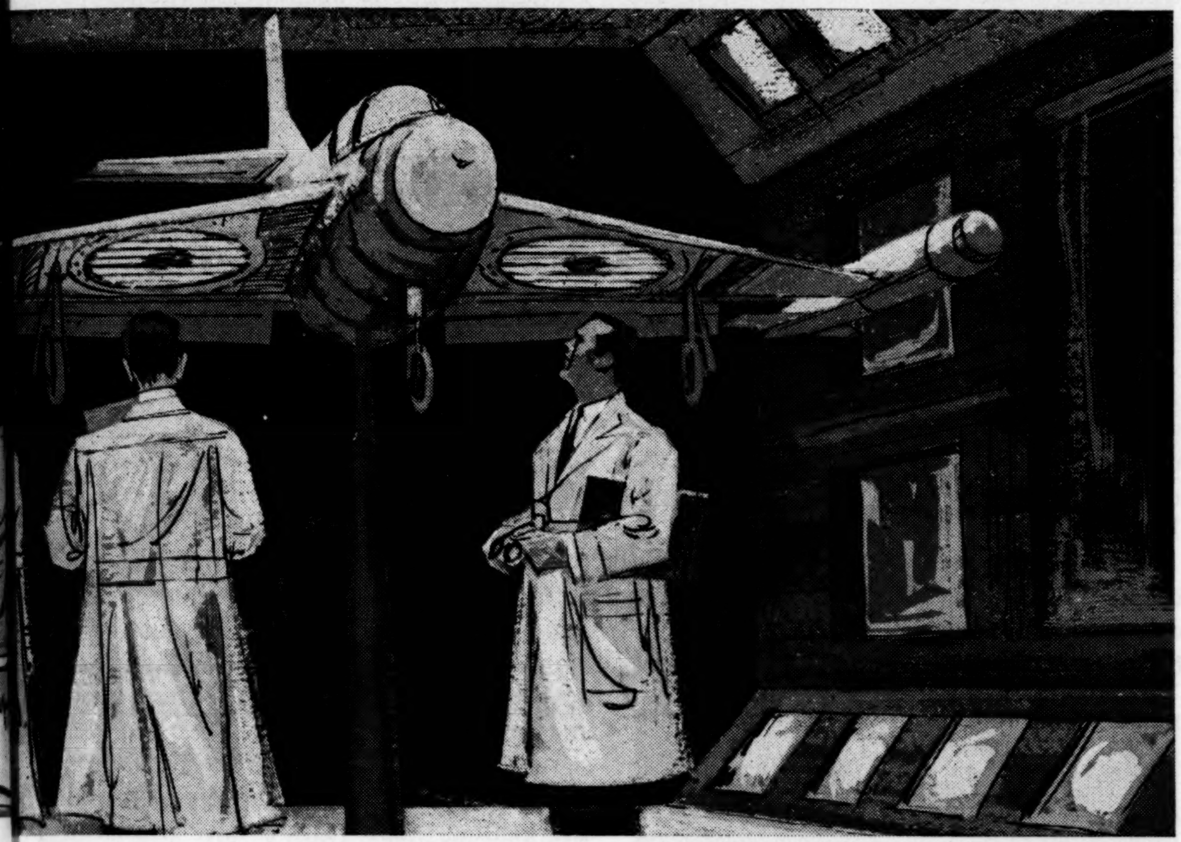


DOUBLE DUTY. NAA-Columbus is building the complete Army Redhead-Roadrunner target missile system. This economical new missile will fly subsonic or supersonic missions and will operate at altitudes up to 60,000 feet.



"HAYSTACK HILL" ANTENNA. A 120-ft. antenna system, using a new concept that distributes tension evenly to avoid distortions in readings, is being built by Columbus for USAF on Haystack Hill near Boston, Mass.

# at NAA-Columbus



V/STOL FACILITIES. NAA-Columbus has one of the largest wind tunnel V/STOL design testing sections in the world (14 feet wide by 16 feet high). This is part of the extensive V/STOL facilities Columbus has used in the development of both lift-fan and tilt-wing aircraft which need no runway for take-off or landing.

ANTI-SUBMARINE WARFARE. NAA-Columbus is at work on new applications of anti-submarine warfare to meet the threat of highly advanced submarines. Other research and development projects at Columbus include advanced battlefield surveillance, and surface-to-air and surface-to-surface missile systems.

ects, including radio telescopes and telemetry applications.

**Collins Radio Co.** of Cedar Rapids, Iowa, will deliver airborne transceivers for use aboard B-52 bombers and KC-135 tankers under terms of an Air Force contract of more than $1.5 million.

**Minneapolis-Honeywell Regulator Co.**'s Boston Division has been awarded more than $2 million in contracts by General Dynamics/Astronautics for rate gyroscopes to be used in Atlas ICBM guidance systems. Delivery will continue into early 1962.

**Kaman H-43B Huskie** helicopter will be used as a flying electronics platform to simulate missile launch conditions for test and calibration of guidance systems at Air Force Titan ICBM bases. Kaman will install the checkout gear on the Huskie at its plant in Bloomfield, Conn.

**The Garrett Corp.**'s AiResearch Manufacturing Division at Phoenix, Ariz., has received Navy contracts totaling $762,000 for air turbine starters to be installed in P3V, W2F and A4D aircraft.

**Kahr Bearing Corp.** of New York has been awarded contracts to supply bearings to aircraft manufacturers in West Germany and The Netherlands. The European companies will assemble and manufacture aircraft and components for the Lockheed F-104 NATO forces fighter program.

**Army** has awarded a $4,746,525 contract to Philco Corp.'s Communications Systems Division for design, engineering and installation of a microwave, tropospheric scatter communications system.

**Bendix Systems Division** at Ann Arbor, Mich., will design, build and test the prototype of a rocket-borne communications system for the Air Force. Air Force Systems Command is developing the system for use in situations where normal facilities are not available.

**Goddard Space Flight Center** has awarded a contract of unannounced size value to Minneapolis-Honeywell Regulator Co. for design and engineering services of a space environment facility to be constructed at Greenbelt, Md. The facility will check-out and test large spacecraft in two space chambers, 35 ft. in dia. and 52 ft. high. The chambers will be in operation by Oct. 31, 1962.

**Ryan Aeronautical Co.** has received a follow-on order exceeding $9 million for production of aft fuselage section for Boeing KC-135 jet tankers and C-135 transports.

# Manned Orbital Assembly Program Urged

By Arthur Kantrowitz

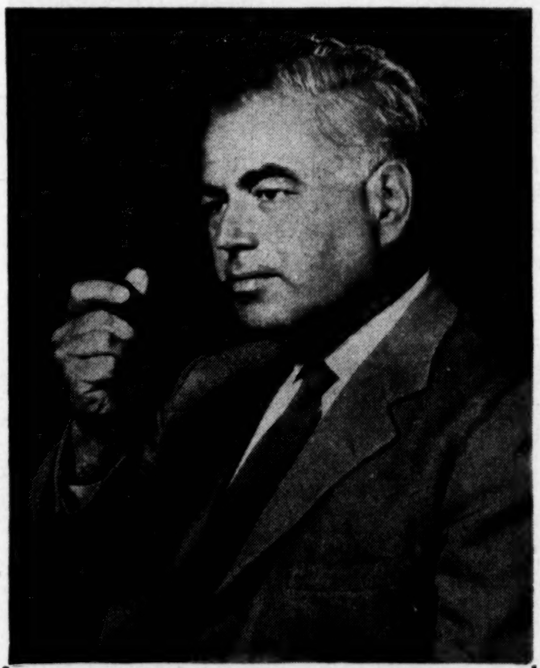
President Kennedy's commitment of this nation to a race for the first manned lunar landing requires a fresh approach. We must remember that as recently as April of this year he was quoted as conceding that we may be "so far behind now . . . we're going to be second in this decade." This paper is intended to call attention to a technique whereby this country can, in two or three years, completely overcome the Russian advantage in booster thrust.

There are two techniques for achieving a large payload weight in space. The first is by assembling it on the ground and developing a sufficiently large booster to put it into orbit. This technique, which has been almost neglected in our space programs, could make it possible for ourselves (or the Russians) to assemble indefinitely large payloads in space. This neglect has persisted despite the recognized technical feasibility and inevitability of rendezvous, as brought out in a long series of engineering studies.[1] Yet present planning[2] calls for cooperative rendezvous only after the Saturn booster is available. It is my belief that manned rendezvous is achievable with presently available boosters and an adaptation of the Mercury capsule.

The achievement of an orbital assembly capability will give America a commanding advantage. It will allow us to utilize our production capabilities since orbital payloads and mission capabilities would depend on the number of boosters we could launch and will not be limited by booster size. We should, therefore, make every effort to enter the manned assembly phase as soon as possible.

To answer the critical question, "How quickly can this be done?," let us consider a simple plan designed to make maximum use of hardware available in 1962. Assume a successful Mercury capsule, weighing 3,000 lb. and capable of orbiting a man. Add radar and optical equipment for measuring distance and velocity of cooperating satellites. Add life support equipment to permit flight up to two days. Add a small controllable rocket for rendezvous maneuvers. Add an airlock mating flange to the exit hatch. The rendezvous Mercury capsule (RMC) will be heavier than the present version chiefly because of the weight of the rendezvous rocket. The velocity increment required has been estimated in several studies.[1] From this work it can be concluded that a controllable rocket weighing less than 10% of the satellite weight will be required. Let us, therefore, assume that all these additions will come to 500 lb. so that RMC will weigh about 3,500 lb.

The system for orbiting RMC needs to be as reliable as possible. This requirement suggests the use of much-tested, smaller boosters rather than new larger boosters. We have presently available, in the Atlas-Agena B, a booster capable of putting 5,300 lb. into a low orbit. This would allow enough weight to accomplish the above functions and to increase the safety factor of the RMC. It will also allow the weight required for adaptations to the Atlas-Agena B to launch the RMC. The time required to achieve rendezvous will depend on how accurately the launch schedule can be maintained. Thus, launching within a 4.7 hr. period allows rendezvous within one day.



**Dr. Arthur Kantrowitz, director of the Avco-Everett Research Laboratory and vice president and director of the Avco Corp., is a native New Yorker who received his B.S., M.A. and Ph.D in physics from Columbia University during the 1930s.**

**Long interested in gas dynamics, Dr. Kantrowitz served as the chief of the gas dynamics section at the National Advisory Committee for Aeronautics, Langley Field, Va., facility from 1936 to 1946 and, from 1946 to 1956, was a professor of aeronautical engineering and engineering physics at Cornell University. He became director of Avco-Everett Research Laboratory in 1955 and joined Avco Corp. in 1956.**

For the orbiting of freight capsules we can use our more advanced boosters, which will not as quickly achieve the reliability necessary to orbit a man. Thus, the Atlas and the Titan, when combined with upper stages such as the Centaur, can launch freight capsules up to about 15,000 lb. When available, the Saturn can be used to launch even larger loads. When we achieve the rendezvous of a man with an unmanned life support capsule designed to allow him to survive for a period of weeks, we will have performed the critical step.* If we have available at that time a capability to launch other men and other freight capsules at a rate of about one a week, we can build up a permanent space station. This station should be established in a low-latitude orbit at an altitude of about 300 miles, this orbit chosen to avoid radiation problems.

When the permanent station has been built up to a point where the primary concern could be shifted from its survival to its utilization for other purposes, we could then build up a capability to assemble vehicles in orbit. The manned mission to the moon requires a vehicle weighing between 100,000 and 200,000 lb. which, in itself, would require 12 to 25 Atlas Centaur launches. The permanent space station and the assembly and checkout equipment might run the total weight requirement up to say 1 million lb. requiring perhaps 100 or 125 Atlas Centaurs. Note that the cost of launching this group of vehicles is comparable to the development cost of Saturn.

Let us summarize the most important requirements to give an answer to the question, "How quickly can this be done?"

1. Modify Mercury to RMC and

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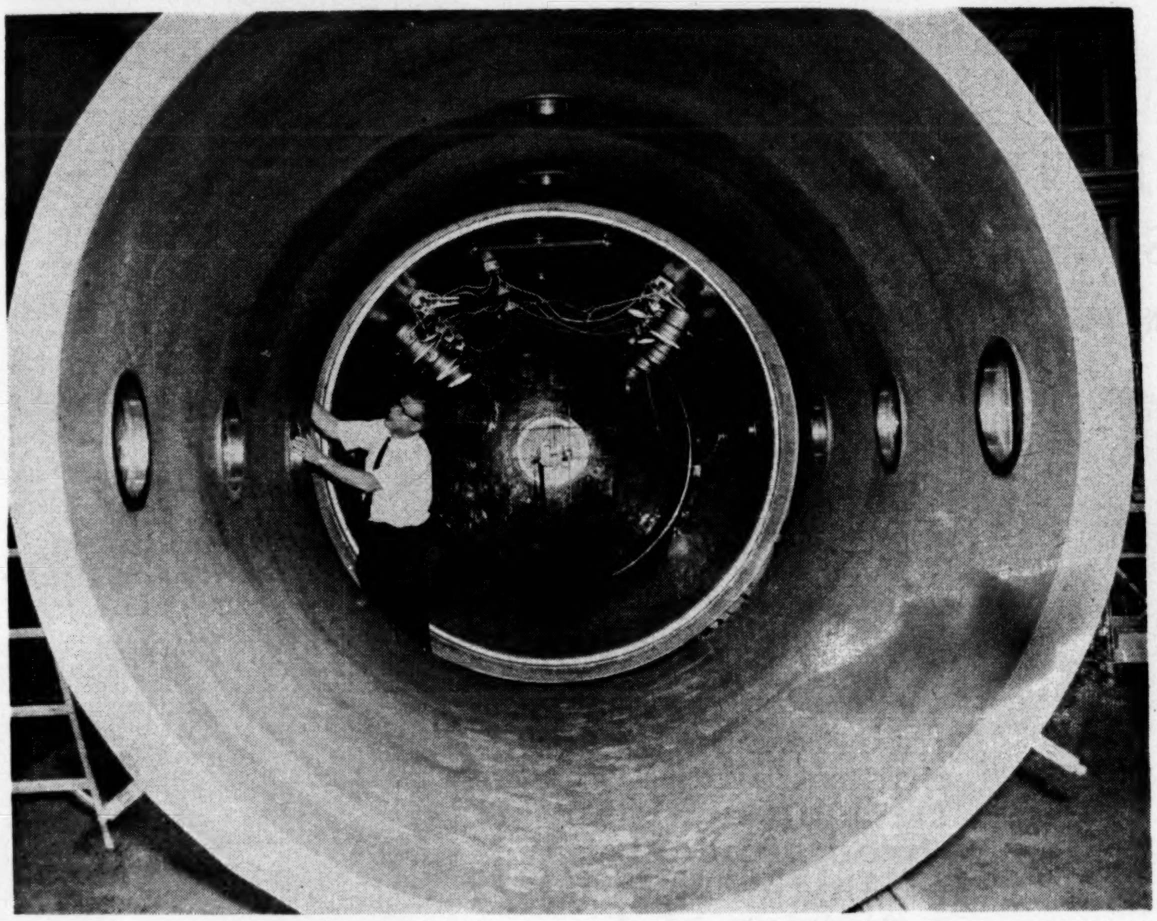
[1] A) Proceedings of the Manned Space Stations Symposium, sponsored by the Institute of Aerospace Sciences with the cooperation of National Aeronautics and Space Administration and The Rand Corporation, Los Angeles, California, April 20-22, 1960.
B) Houbolt, John C.: Problems and Potentialities of Space Rendezvous. Presented at the International Symposium on Space Flight and Astronautics of the International Astronautical Federation, Louveciennes, France, June 19-21, 1961.

[2] Hearing before the Committee on Science and Astronautics, U. S. House of Representatives, May 23, 1961: Orbital Rendezvous in Space.

* Note that men are orbited in capsules designed to re-enter, so that if rendezvous is not successful, de-orbiting and re-entry procedures can be initiated.



## Aeronutronic Expands Vacuum Test Facility

**Vacuum test chamber at Ford Motor Co.'s Aeronutronic Division, Newport Beach, Calif., was recently extended to 27 ft. in length and eight tons in weight by the addition of this 8-ft. dia., four-ton segment. Facility can now simulate altitudes up to 150 mi. Chamber has been used to test USAF Blue Scout payloads and NASA lunar capsules.**

adapt it to an Atlas-Agena B launch vehicle.

2. Develop a life support capsule for Atlas (or Titan) Centaur launch vehicles.
3. Make available production and launch capabilities (eight launching pads) to launch about 100 Atlases (and upper stages) per year.

If these tasks are compared with the job that was done in achieving our initial ICBM capability, it will be seen that the accomplishment of a permanent manned orbital station should take no longer than two to three years if we pursue it with the urgency and enthusiasm of the ICBM program. Following the achievement of a permanent manned station, the assembly, the launching of the assembly gear and the moon vehicle could be undertaken. The development and qualifications of the moon vehicle should certainly be begun immediately and again it now certainly appears that none of these components involve greater leaps in technology than those faced in the achievement of the ICBM program.

### Space Laboratory

Another important use of such an assembly capability would be the erection of a permanent laboratory in space. Such a manned laboratory would perform the assembly function mentioned earlier and various other technical functions–such as the maintenance of sophisticated satellites. But to my mind its most important function would be in the provision of a laboratory where scientists of many disciplines could begin the exciting process of broadening their vision to encompass the really new ideas which everyone feels intuitively will be forthcoming from men in space.

I submit that the achievement of a laboratory of this kind would further strengthen our hand against the spectacular feats which the Russians are producing. It would help to prevent, for example, the disastrous situation which could result if the Russians, by acquiring a broader vision of the potentialities of space, were the first to achieve really new ideas.

### Production Capabilities

The great strength of American production capabilities has not been brought to bear on our space program. The achievement of rendezvous would give us a payload capability in space limited only by our production abilities. Thus, we need never again worry about the consequences of the Russian lead in the thrust of individual boosters. Many of our production facilities are currently idle and the adaptation of some of these to the mass production of existing boosters is no more formidable a program than the task we faced in the World War II production of military aircraft. Note that our present production capabilities for Atlas and Titan, if fully used and if paralleled with adequate production of the smaller upper stages, would allow us to put several million pounds a year into orbit. If needed, we could expand these production facilities at a rate the Russians could not match.

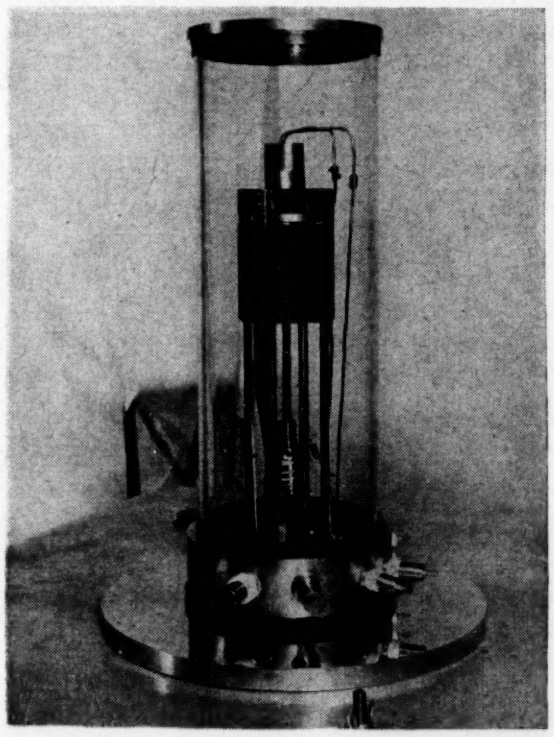
It has been almost unanimously agreed that manned rendezvous and assembly in space will eventually become a major phase of the space program. There are decided advantages to beginning this phase as early as possible. The question that should be put is, "Can not manned rendezvous and assembly in space be begun with hardware available in 1962?"

## Martin Testing For Space Isolation Effect

Martin Co. tests indicate that a space vehicle astronaut may begin losing alertness after approximately $\frac{1}{2}$ hr. of isolation.

Experiments, being performed in conjunction with National Aeronautics and Space Administration's Project Apollo manned lunar flight system, are aimed at determining pilot's vigilance and fatigue factors—then providing for adequate compensations.

Tests are conducted by having volunteers spend several hours inside locked, soundproof booths. Lights, sounds and electronic images are utilized to test the responses of the volunteers.



## Thermionic Converter

**Thermionic converter, which has produced 200 watts power with 13% efficiency, is now under test by Tapco New Devices Laboratories of Thompson Ramo Wooldridge for solar-powered thermionic space vehicle power system. TRW says its Tapco Inglewood laboratory has produced a 5-ft.-diameter solar concentrator by an electroforming process which has a circle of confusion of only $\frac{3}{8}$ in. and with surface reflectivities of up to 92%.**

SUBSYSTEMS DEVELOPMENT FOR MANNED SPACE VEHICLES

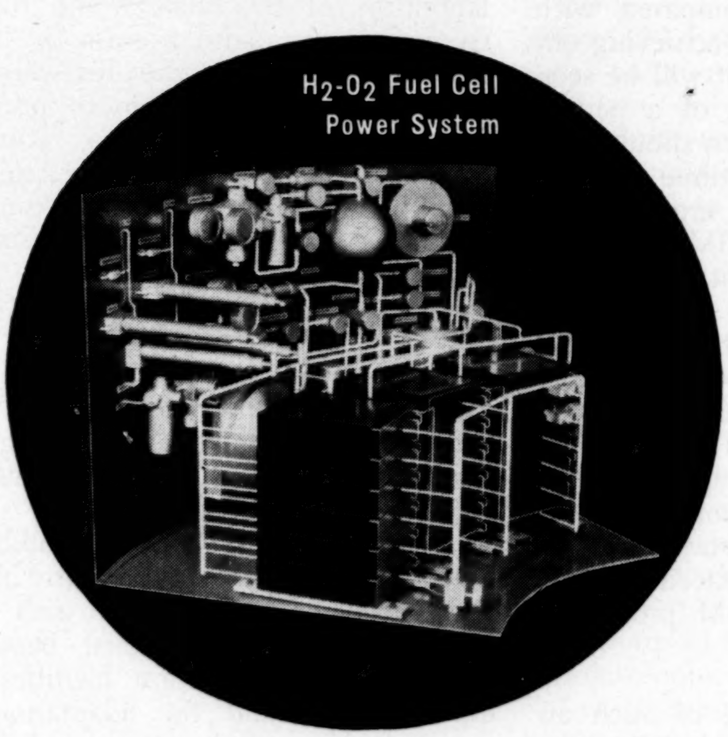
ONBOARD POWER — ENVIRONMENTAL CONTROL — FLIGHT CONTROL

Integrated
Subsystem
Development is a
three dimensional
reality at TAPCO
a division of
*Thompson Ramo Wooldridge Inc.*

**ONBOARD POWER**
Fuel Cell, $H_2$-$O_2$ Dynamic, Hydrazine Dynamic, Solar Dynamic, Solar Thermionic, Systems Utilizing Nuclear Energy

**ENVIRONMENTAL CONTROL**
Open Cycle Stored $O_2$, Electrolytic $O_2$ Regeneration, Photosynthetic $O_2$ Regeneration, Temperature Control

**VEHICLE FLIGHT CONTROL**
Attitude & Orientation Rockets, Electro-mechanical Actuation, Pneumatic Actuation

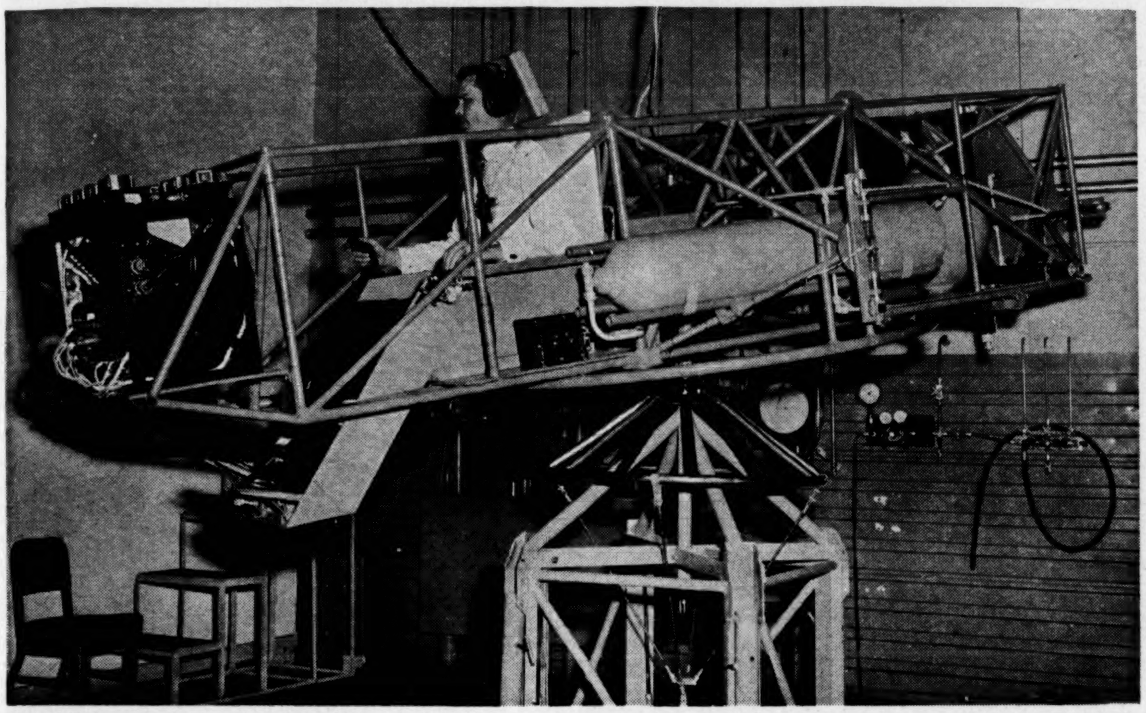


$H_2$-$O_2$ Fuel Cell
Power System

TRW TAPCO

*Thompson Ramo Wooldridge Inc.*

23555 Euclid Ave., Cleveland 17, Ohio



**CONTROLS EVALUATION** simulator is operated by project engineer R. M. Johnson, using side-arm stick and foot-pedals to control roll, pitch and yaw gas reaction jets.

## Simulator Tests Space Controls

**Dallas, Tex.**—Automatic controls evaluation equipment, suspended upon a column of nitrogen gas pressurized to 120 psi., is being used by Chance Vought Corp.'s Astronautic Division to develop and test new systems designed for use in space.

The simulator is the first of three company-financed devices planned for its "space on earth" testing capability—the others will be an environmental simulator for duplicating vacuum, cold and solar radiation of space and a manned space flight simulator to enable personnel to realistically experience almost any type of space mission including maneuvering, navigation and re-entry problems.

ACES, the abbreviation for Automatic Controls Evaluation Simulator, is a 12-ft.-long, 30-in. x 36-in. aluminum tubing enclosed platform, with a 4.5-in. diameter polished steel ball fixed to the bottom of the frame providing the air-bearing surface to afford a nearly frictionless connection to the column of nitrogen gas.

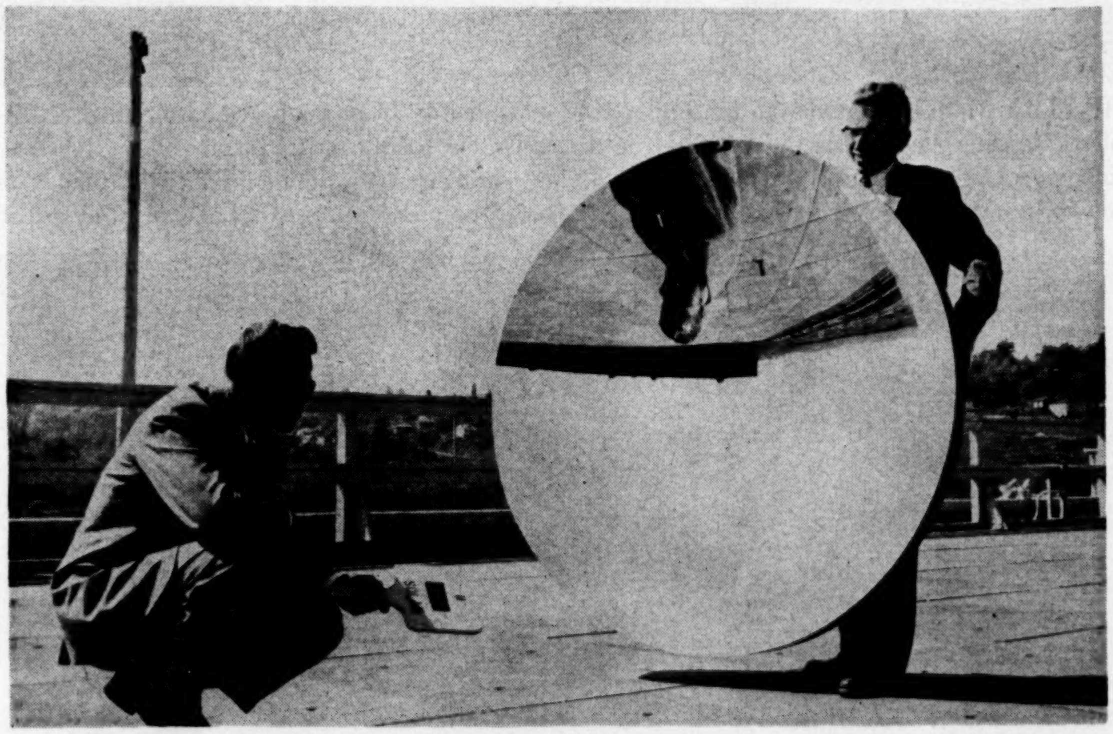
The simulator can rotate freely about its vertical axis and is capable of rotating 35 deg. in pitch and roll, being restrained in the latter to prevent tumbling off the gaseous column by a pyramidal steel tube cage which acts as a shock absorber at these extremes of motion. Frame is fitted with eight reaction jets for control—two for pitch, two for yaw and four for roll. Gas for these jets comes from tanks of nitrogen mounted on the frame. Gas pressure is 3,000 psi. Pitch and yaw jets provide 10-lb. thrust each and the roll jets provide two pounds per valve. Thrusts actually are variable up to 15 lb. by varying pressure and orifice. All valves are on/off solenoid actuated.

Onboard instrumentation includes an 18-channel oscillograph, permitting control inputs in pitch, roll and yaw, attitude and rate gyro output for each axis and reaction jet thrust and valve signal. A flexible umbilical provides electrical power and connections to the remote console. In this condition the simulator is limited in its yaw axis; but if the test requires, a power source can be mounted aboard the frame and the umbilical can be disconnected.

ACES can accommodate a pilot for manual control of the simulator or it can be controlled by a remote console. Manual control is affected by displacement of a side-arm control stick for pitch and roll and toe pedals for yaw.

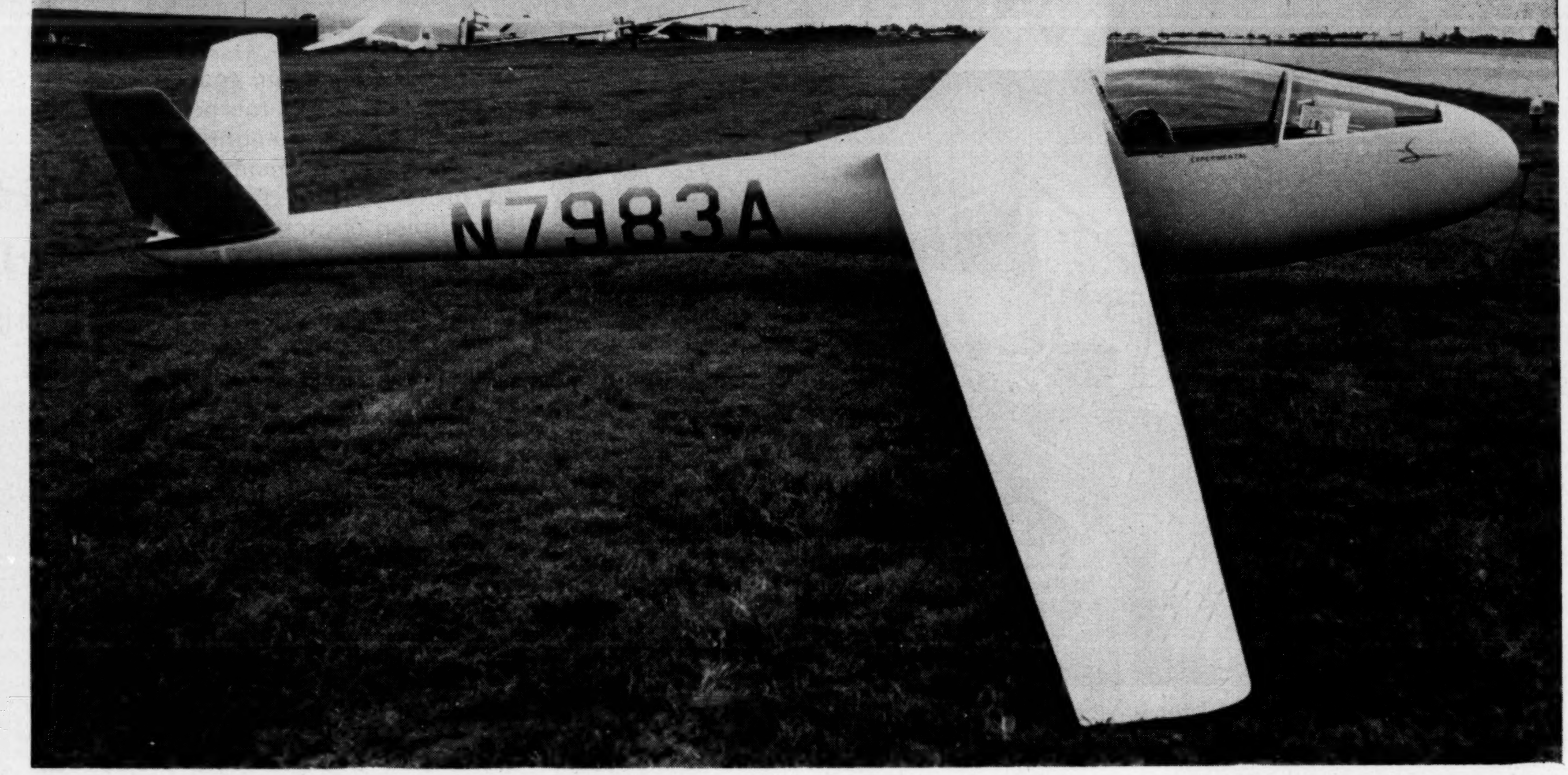
The simulator mounting is so well balanced that the room must be sealed to prevent drafts from upsetting its equilibrium or exerting forces that must be countered to an unnatural degree by the equipment under test. Chance Vought, a subsidiary of Ling-Temco-Vought, Inc., states that in addition to checking out guidance and control equipment planned for spacecraft use, the simulator will be useful in measuring the effects on a space vehicle of such operations as erecting antennas or a solar cell array, ejecting devices such as decoys or interceptors and launching of piggyback space vehicles. In conjunction with the air-cushion platform the company has developed space mechanic repair tools (AW Apr. 17, p. 54).

The simulator is being used initially on Chance Vought space projects exclusively, but later will be made available on a contract basis to government agencies and industry. Among the first equipment evaluated by the company has been a new twin-gyro controller developed by its Electronics Division under a contract from National Aeronautics & Space Administration. Equipment has a pointing accuracy of approximately a one-half arc-second. Future assignments include priority evaluation of a company-developed detector-tracker optical system equipment for space use. Utilization of momentum wheels to change space vehicle direction by varying speed of wheels, electronic circuitry, valves, sensors, fuel and power consumption are among other future programs envisaged.

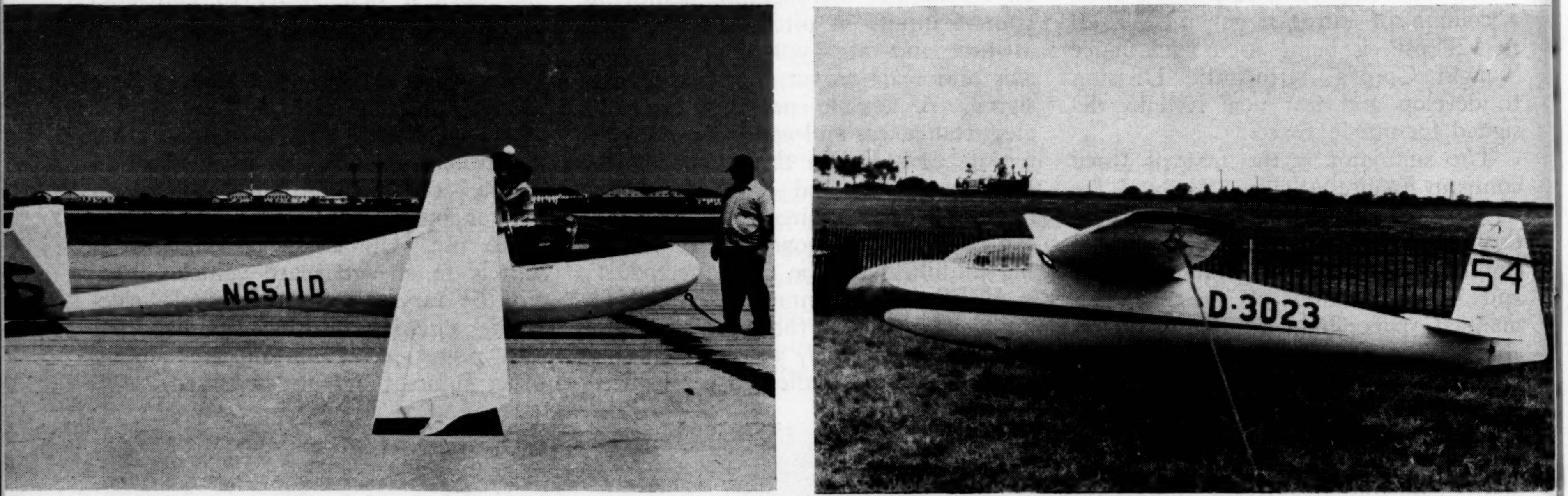


## Solar Concentrator Studied for Space Power

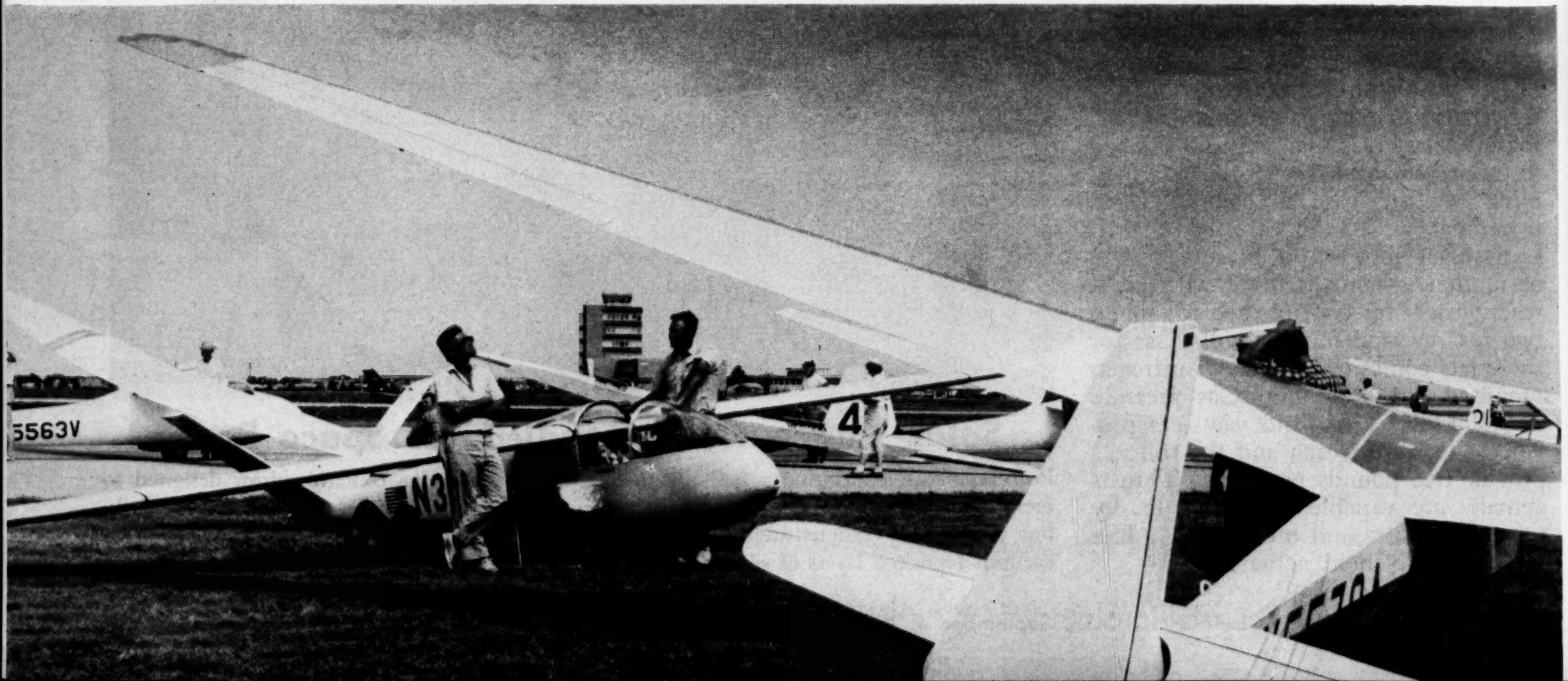
Prototype solar concentrator built by Boeing Co. is a 5-ft.-dia. concave mirror designed to focus sunrays onto the cathode of a thermionic converter. Prototype mirror weighs 16.5 lb. but production versions might weigh only 8-9 lb. Mirror's reflecting surface is made of vacuum-deposited layers of silicon monoxide and aluminum.

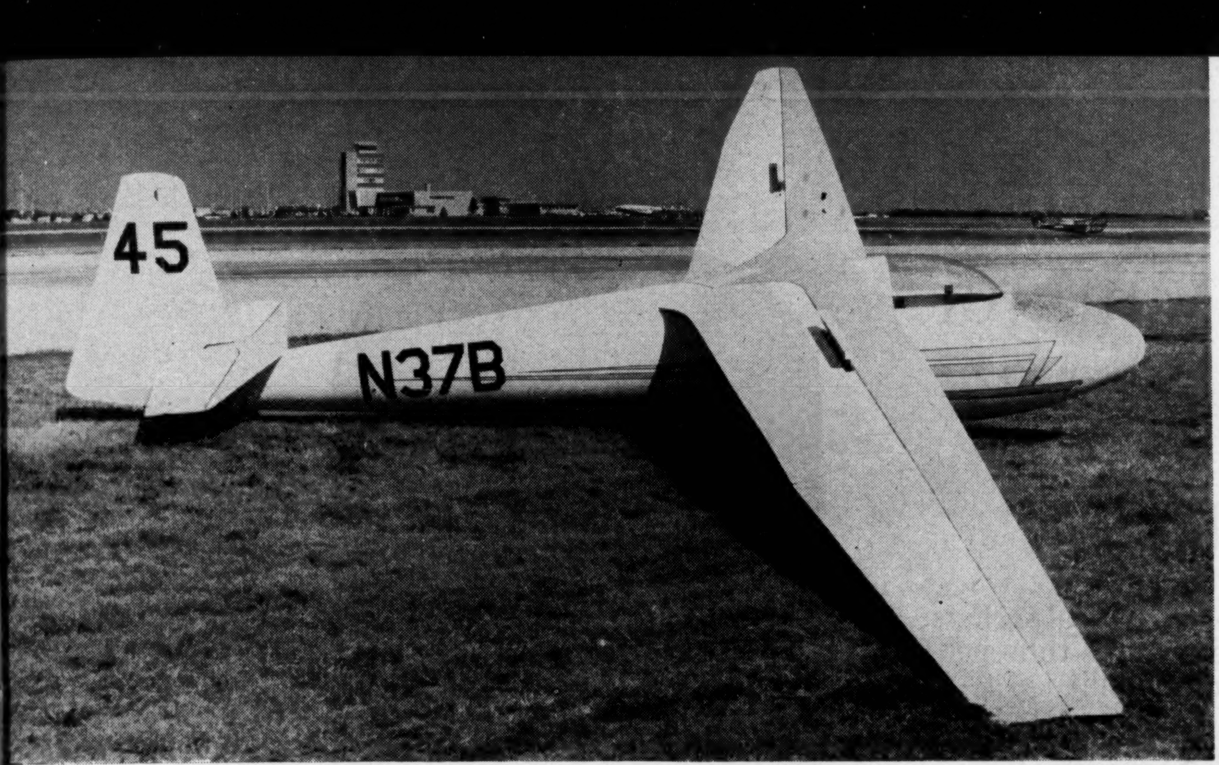


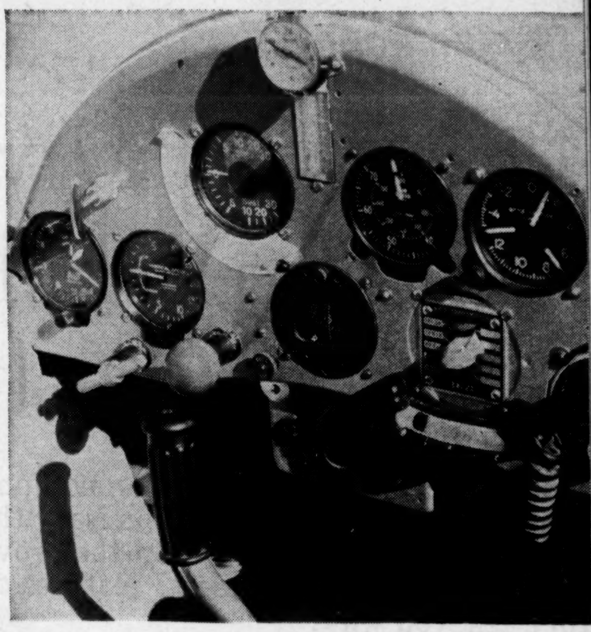
All-metal Niemi Sisu 1 has finish so smooth it looks superior to many polished wood and fabric coverings. Wing trailing edge inboard of ailerons is mechanically warped to reduce possible turbulence drag caused by gap of conventionally split trailing edge flaps. John D. Ryan, Scottsdale, Ariz., flew Sisu shown on best distance flight—about 330 mi.—during 28th annual U.S. soaring championships at Wichita, Kan. (AW Aug. 21, p. 96). Sisu sells for about $6,000, but one finished to the standard of Ryan's would cost closer to $10,000.



HP-10 Air Mate (left), a design by former National Soaring Champion Richard Schreder, has metal honeycomb bonded wing with Royalite plastic leading edge. Kaiser KA-6 CR (right) owned by John Slack, Napierville, Ill., has German-style tow winch hook on lower side of fuselage, just ahead of single wheel. Below, sailplanes competing in 28th annual U.S. soaring championships are positioned along runway at Wichita. V-tailed sailplane at left foreground is HP-8. Airliners operated on other side of airport during competition.

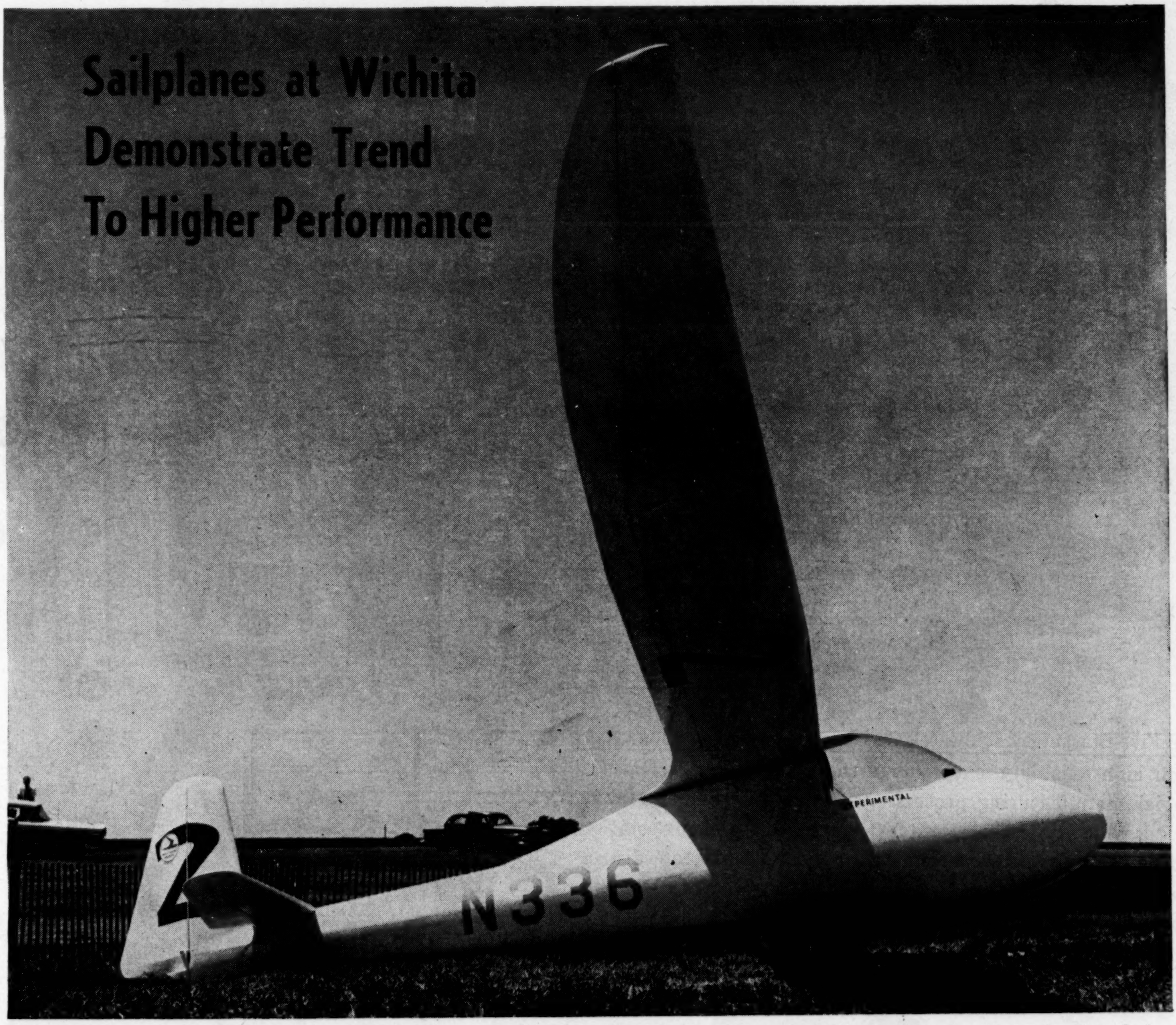






Kaiser KA-6 (left) typifies new foreign sailplanes, particularly German types, which are becoming very popular in the U. S. because of performance and low price (about $3,000 here). Of 36 sailplanes competing at Wichita, nine were KA-6 models, and one took third place in total point scoring. Well-equipped panel at right on R. L. Moore's Schweizer 1-21 typifies advanced soaring pilot's need for instrumentation and two-way radio. Three types of variometers to measure vertical speed run diagonally to left under stopwatch. Semicircular scale bordering center instrument is calibrated so pilot can accurately gage thermal strength so he can vary speed to pass from one to another most effectively. Pitot measures constant air energy; total energy variometer is unaffected by sailplane's speed.

# Sailplanes at Wichita Demonstrate Trend To Higher Performance

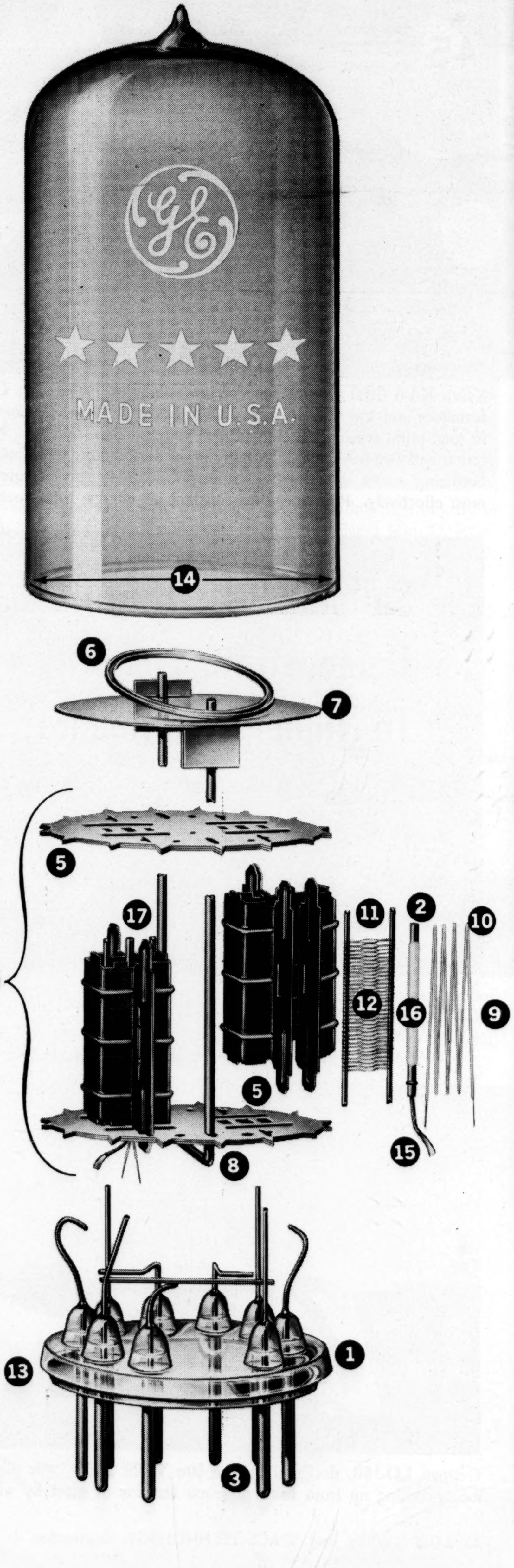


German LO-150, designed by the late Wolff Hirth, was piloted by A. J. Smith, Tecumseh, Mich., to first place in total points during meet, coming up from third place on last day of meet by winning final event, an 80-mi. speed run to Salina, Kan., at 42.2 mph. average.

**ELECTRONICS**

# 17 reasons why you get highest reliability with G-E Five-Star tubes

In industrial and communication equipment—critical sockets where there can be no compromise with electronic tube performance—you can depend on the proven reliability of G-E Five-Star tubes. Let these 17 features of a typical Five-Star tube tell you why:



① *Stem design minimizes welds—fewer points of possible failure—less chance of short-causing particles from weld splash.*

② *Passive cathode alloys assure reliability and long life in low-duty cycle circuits where interface tends to develop.*

③ *Pins are annealed to prevent glass strain at socket insertion.*

④ *Short, sturdy cages increase rigidity of tube structure.*

⑤ *Two mica spacers, with additional anti-leakage slots, brace internal parts, provide superior inter-element insulation and improve vibration characteristics. 12 or 16 contact points give firmer fit between bulb and mount.*

⑥ *Highly efficient getter performs throughout tube life and guides flash to avoid inter-element leakage.*

⑦ *A getter flash shield improves initial leakage characteristics.*

⑧ *U-bolt construction through top and bottom micas firmly secures the cage assembly.*

⑨ *Folded heater design proved most reliable under shock, vibration and heater cycling conditions. Heater is temperature controlled to further improve reliability and lengthen life.*

⑩ *Cataphoretic coating of all heater bends after forming insures complete heater-cathode insulation.*

⑪ *Smooth grid legs prevent a "sawing" action on the mica, reducing grid vibration and microphonic noise.*

⑫ *Critical grids are plated with gold or silver to minimize grid emission.*

⑬ *Lead glass stems help ward off glass electrolysis.*

⑭ *Controlled inside diameter on bulbs improves vibration and microphonics.*

⑮ *Low thermo-conductivity cathode tab prevents terminal heat loss.*

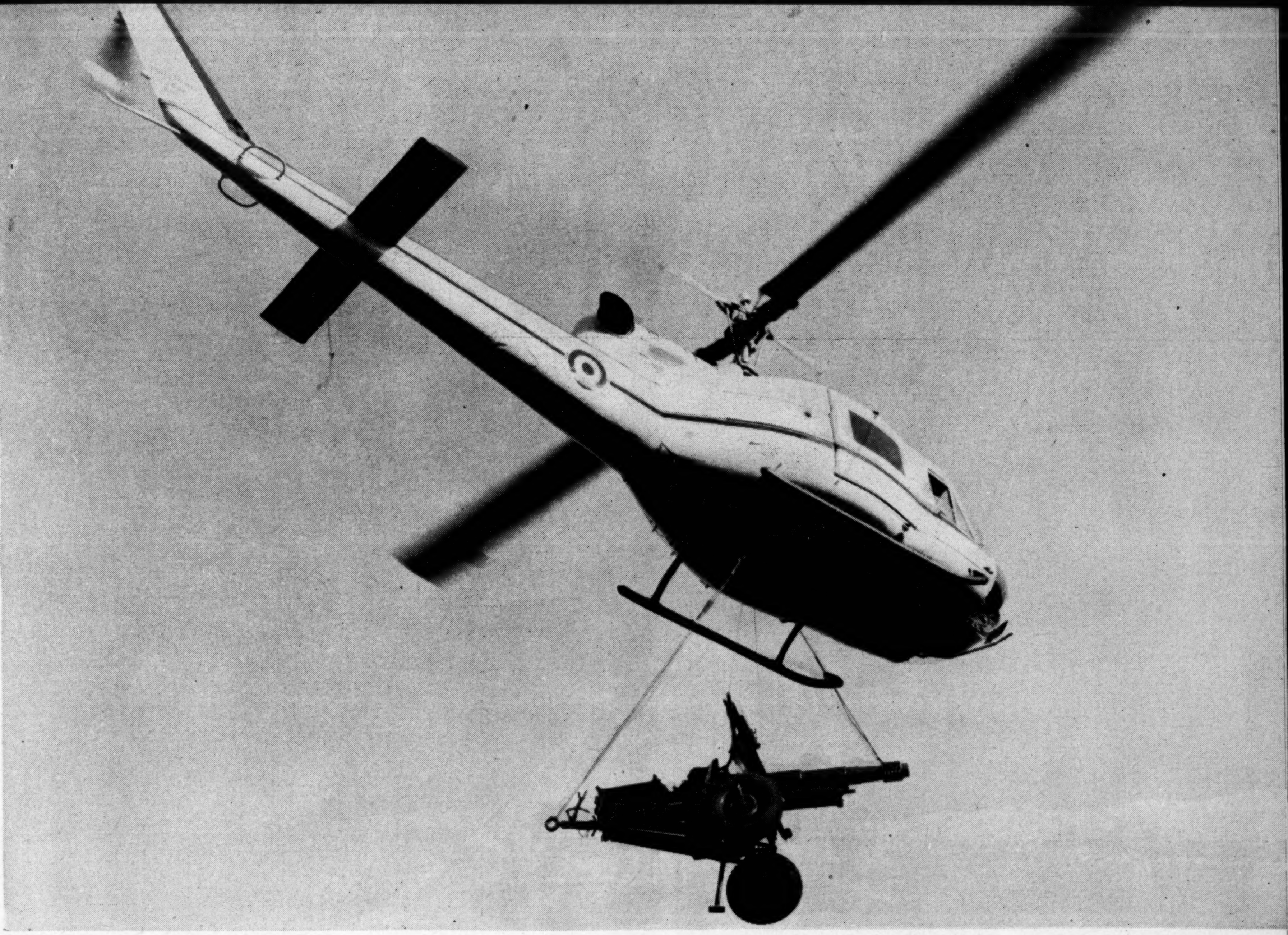
⑯ *Outside diameter and density of cathode coating is statistically controlled.*

⑰ *Plate ears are embossed for added strength and improved mica fit.*

G-E Five-Stars are not tubes selected from standard receiving types. Their high reliability is a result of these special design features, special manufacturing processes, special tests, and stabilizing periods which may even exceed 200 hours of full-voltage operation. Order G-E Five-Star tubes from your General Electric tube distributor. He has them in stock. General Electric Company, Distributor Sales, Room 7150A, Owensboro, Kentucky.

*Progress Is Our Most Important Product*

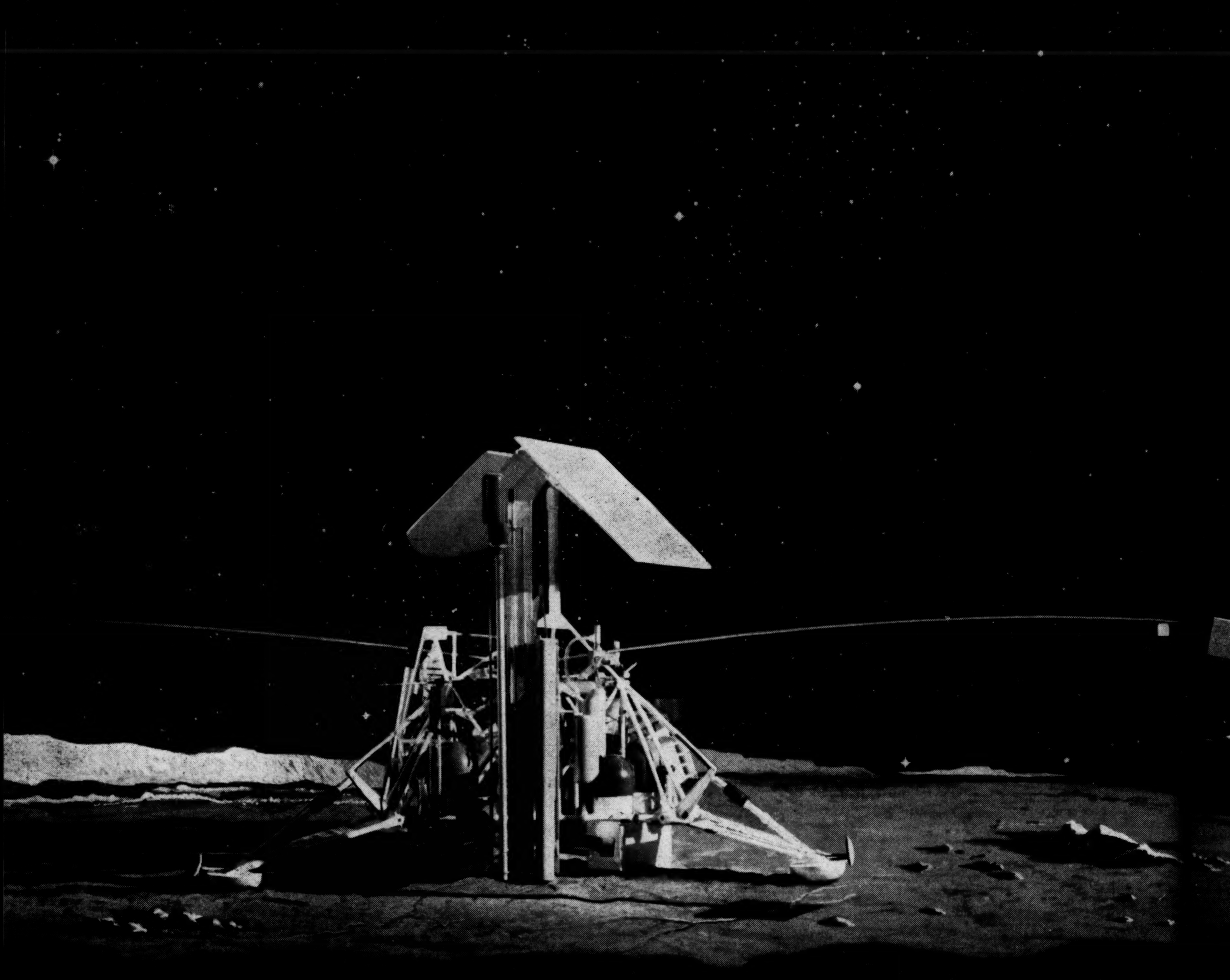
**GENERAL ELECTRIC**



Army artillery piece hangs by sling under DH Gnome-powered Augusta-Bell 204 which the Italian firm builds at Milan under license to Bell. Two gunners were carried in the cabin of the helicopter, which has a maximum gross weight of 8,500 lb.

# Augusta-Bell 204 Shows Versatility

Nine Italian Army Fusiliers, with full combat gear, climb aboard the 204 (below, left). At right, the Gnome-powered helicopter sling-carries a jeep-type vehicle. Demonstration was conducted at Rome's Urbe Airport for Italian government and military officials.



# What will the Surveyor find on the moon?

**Sometime in 1963,** this spacecraft will land on the moon. In it will be over 200 pounds of scientific instruments designed to gather, analyze and transmit information about the moon's surface, subsurface and atmosphere.

The Hughes-designed Surveyor will be built to "soft land." As it approaches the moon, after a 66-hour flight from the earth, retro-rockets will be fired to cushion the impact of landing.

Then, standing on three legs, the 750-pound moon explorer will set to work—as scientists here on earth watch via television. High-quality television pictures of the lunar landscape will be taken and transmitted. Drills will pierce the moon's surface and samples will be brought up into the spacecraft for chemical analyses. Other instruments will measure the geophysical characteristics of the lunar surface, as well as the moon's magnetic and radiation fields.

Hughes will build seven Surveyor vehicles which are scheduled to be launched at Cape Canaveral during the period 1963-66. The work is being performed for the National Aeronautics and Space Administration. Technical direction is by the California Institute of Technology Jet Propulsion Laboratory.

The information which Surveyor gives us will be an important step toward the day when man himself will stand on the moon and look out into the universe.

**Creating a new world with electronics**

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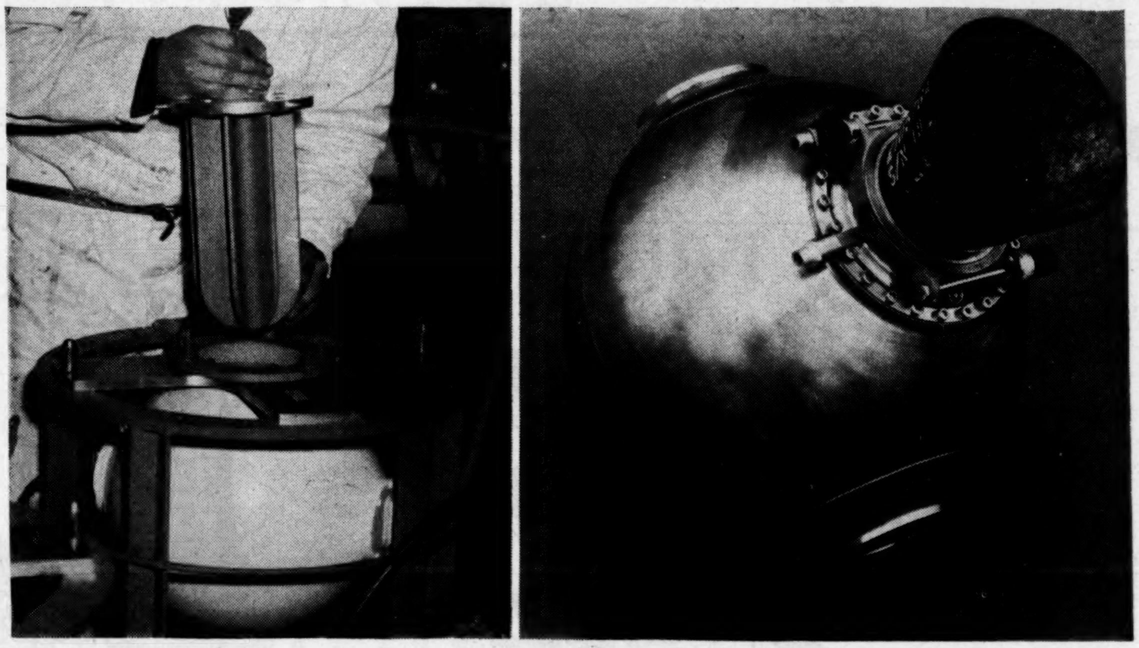
**lectronics is our business.** Imaginative ioneering in advanced electronics by nore than 5,000 Hughes engineers and cientists is speeding man's progress in a ost of new ways — with revolutionary -dimensional radar systems, with ion ngines to take man on long space jour- eys, with computers that can do years of ork in hours. Such creative efforts have elped build Hughes into one of the orld's most important producers of elec- ronic systems and products.

# MISSILE ENGINEERING



## Titan II to Use Solid Propellant Vernier Engines

**Two spherical solid propellant vernier motors, 13 in. in diameter and weighing about 80 lb. each, will be used on the Titan II missile for final velocity increments and thrust vector control. The motors, developed by Thiokol's Elkton, Md., Division, use a polyurethane type propellant and are located beneath the skirt of the second stage. Thrust termination is achieved by blowing out the vitreous silica phenolic nozzle. Core (above, left) is inserted into the spherical casing while the propellant is still fluid.**

## New Process Provides High-Pressure Cases

New York—Cryogenic metalworking process, which gives tensile strengths of 260,000 psi. and above with conventional stainless steel stock, has been developed by Arde-Portland, Inc., Paramus, N. J. in a bid to provide lightweight, low-cost satellite pressure vessels and cases for the expanding field of solid propellant motors.

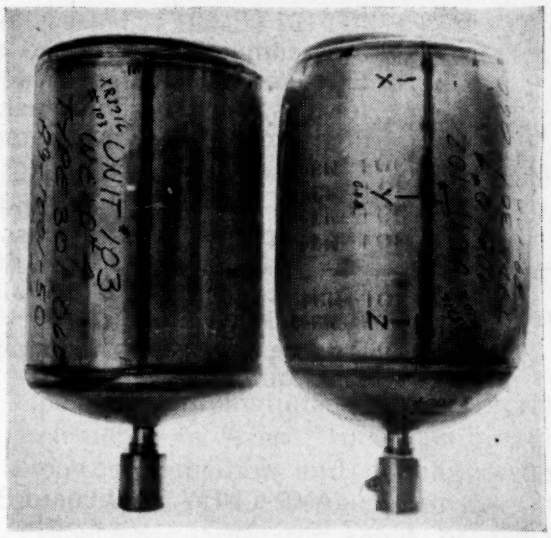
Arde says the process costs 15 to 38% less than conventionally heat-treated vessels, offers much greater strength and ductility characteristics and that fewer steps—9 compared with 16 in a standard heat-treat process—are involved in the fabrication of any given case size.

Using AISI-301 (American Iron and Steel Institute grade) annealed steel, Arde has welded 16 in. diameter spheres and 48 in. long, 12.5 in dia. cylinders with regular welding techniques. These vessels, called pre-forms, were then placed in a cylindrical forming die and then both die and pre-form filled with liquid nitrogen at -320F.

Gaseous nitrogen was then forced into the pre-form under high pressure and the vessel expanded to the limit of the die.

Arde has expanded the diameters of cylinders 13%, achieving in the process a strength of 260,000 psi. and a wall thickness of 0.050 in. Yield point is about 250,000 psi.

The company, citing the advantages of the process of forming any size vessel, lower case weight, higher material strength and lower production and tooling costs, sees an immediate market in gas pressure spheres of the type carried aboard Agena and AbleStar vehicles and future sales for solid propellant motor cases, both segmented and unsegmented. For segmented cases, Arde says that joining flanges can be welded to the vessel after processing and the domes of the unit have been removed, and the case then re-inserted into the tank for cryogenic re-strengthening. Using various alloy materials, the company believes it can produce vessels up to 385,000 psi. within one year.



**CRYOGENIC STRETCH-FORMING, a metalworking technique developed by Arde-Portland, Inc., expanded the case diameter at right about 13%, giving a tensile strength of 260,000 psi. in the process. Pre-form case at the left was rated at 102,000 psi.**

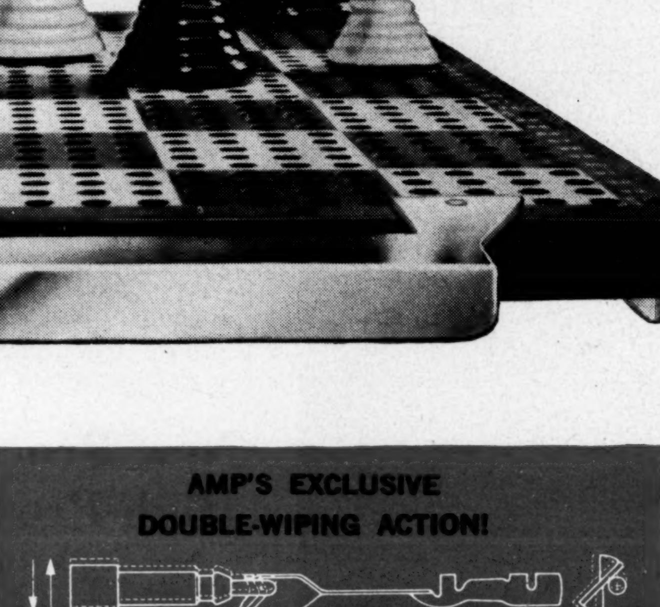
THE
MOVE
THAT
COUNTS

AMP assures dependable programming performance with a patented double-wipe action which brightens contact surfaces . . . scrubs them clean of current-killing contaminants beyond the final contact operating point to provide a cleanly wiped contact area. This allows AMP systems to achieve .090" of wiping action with only .060" of pin travel after first contact with spring.
In addition to this "move that counts" AMP patchcord programming systems offer these features:

PATCHBOARDS
(Universal and Shielded types)
- Choice of general purpose boards in phenolic or diallyl-phthalate, and shielded types for critical low-level applications.
- Removable patchboard permits easy storage of predetermined wiring programs.

PATCHCORD PINS
- Pins compression-crimped onto conductor.
- Extended nylon sleeves act as insulation for pins, and provide proper seating of pins in board with positive detent action.

CONTACT SPRINGS
- Unique chevron design and 45° twist permit amplified contact pressure and wiping action . . . assure longer life.
- Contact springs are self-aligning and are locked in rear board.
- Provide receptacles for taper pins to facilitate equipment wiring.



AMP'S EXCLUSIVE
DOUBLE-WIPING ACTION!

(D) Pin moves back from point of maximum travel and rests in a previously wiped position.

(C) Pin moves upward and across chevron to a point of maximum travel, while unique design of chevron wipes core pin back to front.

(B) Operating handle is engaged and pin moves upward to touch chevron on contact spring.

(A) Board and pins in position before closing of operating handle—no contact at this point.

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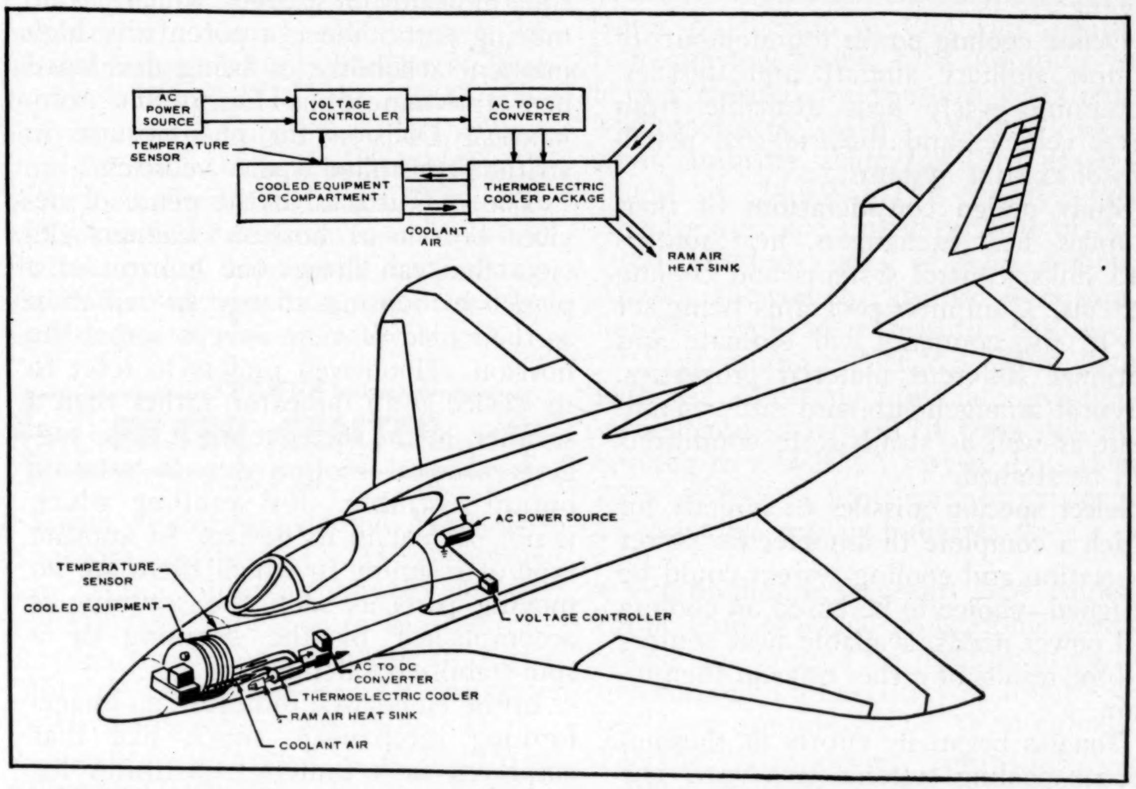
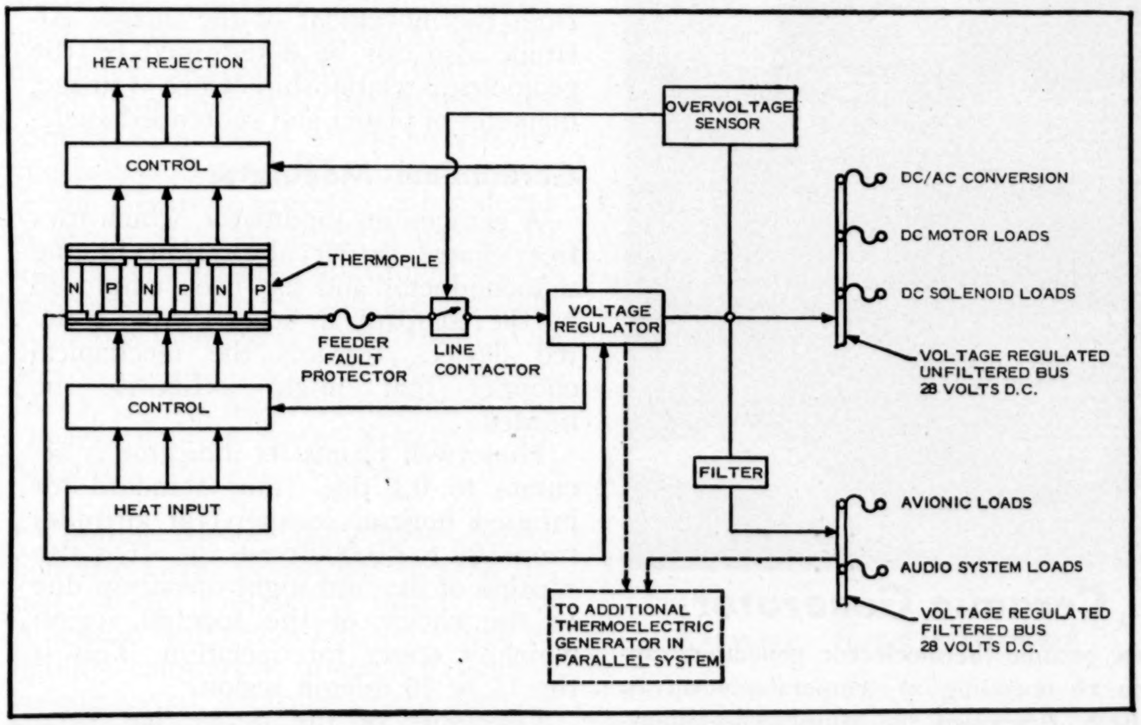
# Airborne Thermoelectric Systems Studied

By Barry Miller


AC POWER SOURCE
VOLTAGE CONTROLLER
AC TO DC CONVERTER
TEMPERATURE SENSOR
COOLED EQUIPMENT OR COMPARTMENT
THERMOELECTRIC COOLER PACKAGE
COOLANT AIR
RAM AIR HEAT SINK
AC POWER SOURCE
TEMPERATURE SENSOR
COOLED EQUIPMENT
VOLTAGE CONTROLLER
AC TO DC CONVERTER
THERMOELECTRIC COOLER
RAM AIR HEAT SINK
COOLANT AIR

**AIRBORNE** thermoelectric cooling system, one of several possible types to be studied by Douglas Aircraft Co. under a Navy-supported program, would employ d.c. voltage derived from conventional aircraft power source for Peltier (thermoelectric) cooling system.


HEAT REJECTION
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HEAT INPUT
OVERVOLTAGE SENSOR
DC/AC CONVERSION
DC MOTOR LOADS
DC SOLENOID LOADS
VOLTAGE REGULATED UNFILTERED BUS 28 VOLTS D.C.
FILTER
AVIONIC LOADS
AUDIO SYSTEM LOADS
VOLTAGE REGULATED FILTERED BUS 28 VOLTS D.C.
TO ADDITIONAL THERMOELECTRIC GENERATOR IN PARALLEL SYSTEM

**TYPICAL** thermoelectric power generation system to be employed in aircraft would have advantage of increased reliability because of absence of moving parts.

El Segundo, Calif.—Airborne power generation and cooling systems based on century-old concepts of thermoelectricity will be investigated by Douglas Aircraft Co. under a $120,000 18-month Navy Bureau of Weapons contract.

The absence of rotating machinery, or any moving parts, in projected systems based on principles of thermoelectricity is expected to add a degree of reliability not found in comparable conventional gear. Thermoelectricity involves the direct conversion of heat into electrical energy. Such sources of heat as the waste heat from jet and rocket engines will be among the promising energy sources available in aerospace vehicles that will get careful attention in the Navy-Douglas program.

In recent years, renewed interest in thermoelectricity, stimulated largely by the availability of new and improved materials (semiconductors), has centered on spot cooling of avionic equipment and the conversion of the sun's heat to electrical energy in space as the principal possible aerospace applications. Navy has sponsored extensive thermoelectric research, primarily in materials, but also in experimental hardware oriented toward use in nuclear submarines. Radio Corp. of America, Carrier Corp. and Whirlpool have worked with the Navy in developing thermoelectric cooling and refrigerating systems for underseas craft (AW Mar. 7, 1960, p. 237).

The use of thermoelectric devices as primary or secondary power systems for aircraft or as aircraft equipment and cockpit cooling systems has been studied by other companies, before the current Navy-Douglas program. At least one firm says it discontinued studies because of its estimates of probable high costs of such systems.

One of the tasks facing Douglas will be to determine the weight, size, cost and engine power penalties that may have to be paid by using thermoelectric systems employing today's technology and level of materials development as well as those that can be expected by 1963.

Two phenomena used in thermoelectric devices are the Seebeck effect (observed in 1823) and the Peltier effect (described in 1834), the Seebeck effect, for many years a valuable laboratory tool as employed in thermocouples, describes the developing of an electrical potential across a load by heating the junction between two dissimilar metals or semiconductors. The Peltier effect is the heating or cooling at a junction of two elements produced by current flow through them.

Douglas will study application of these phenomena in separate systems and a single combined power generation and cooling system. It will consider venting waste exhaust heat to a thermoelectric generator consisting of parallel combinations of many thermoelements in series. In a combination power generation and cooling system, part of the D.C. output from the thermoelectric generator could be fed to another series of thermoelements to produce necessary Peltier cooling.

The present program will divide into two phases. They are:

- **Phase I**—Gathering of data and investigation of thermoelectric power generation and cooling, an 11-month effort scheduled to conclude next March.

- **Phase II**—Selection of specific vehicle and the design of a system or systems for that vehicle. This will be a six-month effort.

Among its tasks in the first phase of the study will be to perform the following:

- **Define cooling** power requirements of sample military aircraft and missiles, determine waste heat available from these vehicles and the fuel-cost penalties of existing systems.
- **Study design considerations** of thermopiles, heat exchangers, heat sources and sinks, control systems and cooling systems. Computer programs being set up by the company will evaluate and optimize different material properties, physical arrangements and sizes. Transient as well as steady-state conditions will be studied.
- **Select specific missiles** or aircraft for which a complete thermoelectric power generation and cooling system could be designed—choice to be based on cooling and power needs, available heat sources and the results of earlier tasks in the program.

Douglas began its efforts in thermoelectric cooling systems two years ago and has made some experimental hardware.

**Ceramic Generator**

**New ceramic thermoelectric generator, capable of operating at temperatures up to 2,400F, developed by Minneapolis-Honeywell under Army sponsorship, has output of 1.0 to 1.2 ma. per degree C, approximately four times the voltage produced by conventional intermetallic materials, company says. Device shown consists of 14 layers, each sprayed with nickel oxide on one side and platinum on the other. The ceramic and metal then are scored with circular saw so they appear to be wrapped around each layer like an unbroken wire. Ceramic material separates each layer and special ceramic nuts and bolts are used to hold layers together. New unit, now under construction, will substitute iron oxide for platinum which is expected to produce even higher outputs.**

# Novel Infrared Horizon Indicator Designed Without Moving Parts

**Los Angeles**—Infrared horizon attitude indicator, or scanner, which has no moving parts, hence a potentially high inherent reliability, is being developed here at Minneapolis-Honeywell's Aeronautical Division for possible use in attitude-controlled space vehicles.

The indicator is in the genre of devices known as horizon scanners—devices that can detect the horizon of a planet by sensing change in radiation as their field of view sweeps across the horizon. Honeywell prefers to refer to its device as an indicator, rather than a scanner, as the latter term, it says, suggests physical motion due to rotating optical assemblies for scanning which is not present in its device. In another type of scanning in which there are no moving parts as such the scanning is accomplished by the spinning of a spin-stabilized satellite.

In the Honeywell indicator, an image-forming mechanism, much like that employed in a camera, substitutes for the scanning action. A lens focuses the image of the earth on a four-sided symmetrical array of thermistor bolometers which can sense pitch and roll errors from the movement of the image. Altitude also can be determined by the geometrical relationship of size of image, diameter of planet and subtended angle.

## Germanium Modulator

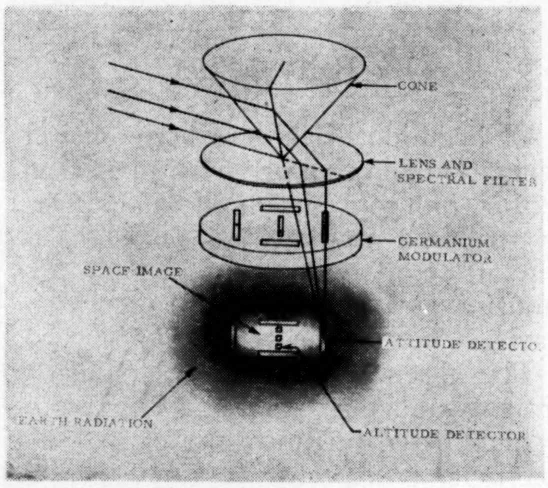
A germanium modulator, which uses free charge carrier absorption in the semiconductor and has been employed by the company in several other infrared devices, replaces the mechanical chopper that might otherwise be needed.

Honeywell claims its indicator is accurate to 0.1 deg. (now standard for infrared horizon scanners) at altitudes from 100 to 60,000 naut. mi. It is also capable of day and night operation due to the choice of the spectral region which it senses for operation. This is the 11 to 20 micron region.

Feasibility of the device has been established, according to the company, although a complete unit has not been assembled. Necessary subassemblies are constructed. The final form of the package would be determined by customer specifications.

In a typical possible configuration, the indicator would weigh about 6 lb., require a like number of watts for power and occupy roughly 125 cu. in. A mean time to failure of about three years is expected, Honeywell engineers say.

Horizon scanners can be employed in space vehicles for such things as the control of booster orientation and alignment during final portion of powered phase, locating local vertical with respect to a planet for satellite in orbit and aiding in stabilization of the attitude of a satellite in orbit and in terminal guidance of an aerospace vehicle.



**CONE objective lens optics of infrared horizon indicator has effect of turning bright earth image inside out. Space surrounding earth becomes dark central disk on image plane while earth becomes the surrounding area on the image plane.**

The Honeywell device might be particularly competitive for non-spinning types of earth centered satellites, its developers say.

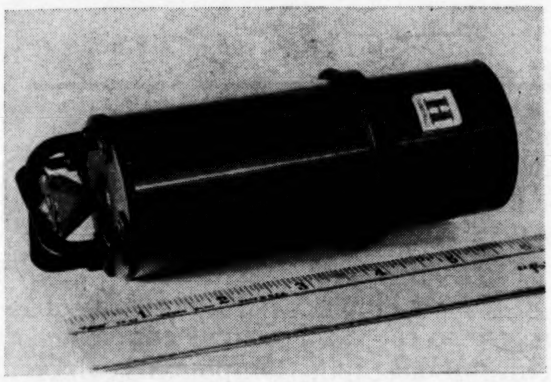
It consists of an optical cone, lens, filter, modulator, detector and electronics. In operation, a radiometric image of the earth is picked up by a conical mirror and focused on a bolometer mosaic consisting of seven thermistor flakes, four of which are arranged in a rectangle. Opposite elements in the rectangle are connected as arms in a bridge with one pair sensing pitch and the other roll displacement.

## Angular Displacement

Angular displacement between the optical axis and the target causes image motion on the mosaic. As the image moves on the mosaic, indicating changing relation of the indicator to the earth, the amount of heat absorbed by the thermocouple flakes changes, causing a change in bolometer resistance. Errors are sensed, error signals amplified and perhaps fed to a vehicle's attitude control system.

The remaining three elements are arranged in a linear array in the center of the mosaic. One element in the center senses only energy from outer space; while the others receive infrared energy when altitude decreases. Decreasing altitude causes the image to shrink.

Bolometer output signals are ampli-



**INFRARED horizon indicator, or scanner, developed by Minneapolis-Honeywell, has no moving parts; consequently, may have unusually long life. Device uses germanium modulator in place of a chopper and image-forming optics for scanning. Final packaged version may weigh 6 lb., draw 6 watts.**

fied in high gain preamplifiers, the modulated signals are separated and filtered, demodulated and amplified before use.

Since the device's accuracy and the size of the image is altitude dependent, a cone is employed before the lens to reduce the image on the mosaic. This type of optic system, the cone and lens, has the effect of turning the earth image inside out. That is, the optical paths of infrared radiation are such that the dark, or outside space, portion of the view appears in the center of the image plane surrounded by a smeared distribution of radiation received from the earth. The cone reduces the apparent angular diameter of the horizon image.

This optical image forming system, engineers here say, has the advantages of:

- **Wide acceptance angles**, thus making the device suitable for low-orbit satellites.
- **Integrating infrared** radiation from the planet's atmosphere and reducing the effect of thermal non-uniformities for the mosaic.

A special optical filter inserted after the lens passes only energy between 15 and 25 microns.

The solid-state (germanium) modulator plus an oscillator driver serves as the chopper. The latter performs two functions:

- **Discriminates "internal"** from "external" radiation—Since the bolometer field of view is an entire hemisphere, it receives radiation from its own case, its optics as well as the target. All this radiation is modulated by the chopper. "Internal" radiation, the company says, is held at a uniform temperature, thus balancing this undesired radiation on the bolometer.
- **Modulates the signal** at 10 cps. rate to permit a.c. amplification in the electronic circuitry.

Mounted outside the cone is a solar cell which senses solar radiation and generates a clamping voltage which shuts the germanium modulator off. This shuttering action is accomplished without the use of any moving parts.

The cone objective lens optical system is suited for vehicles at altitudes from 50 to 1,000 mi., according to Honeywell engineers. Other versions using this concept might be suitable for sensing altitudes up to 100,000 mi., they add.

The system makes unnecessary the mechanical scanning which might be needed at low altitudes because of large angles subtended by the earth. The horizon angle is transformed by the cone from the wide angle it might ordinarily be to a small circular image. The image will retain full sensitivity to attitude and altitude errors, Honeywell says, changing its size and position one degree for each degree of change in the object.

## FILTER CENTER

▶ **Soviet Transistor Manual Available**—English translation of a 450-page Russian "Manual of Semiconductor Triodes and Diodes," published in Moscow earlier this year, is now available from the Office of Technical Services, Commerce Department, Washington 25, D. C. Publication, identified as 61-31116, is priced at $6.00.

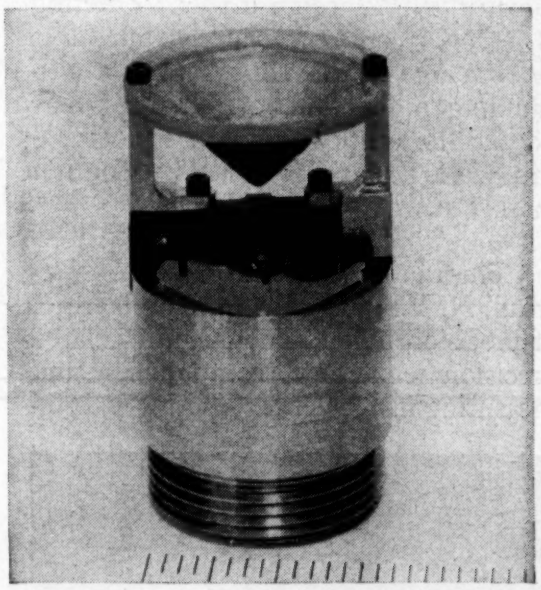
▶ **Soviet Labs Admit Problems**—Soviet industrial research laboratories are having trouble competing with universities for scientists and technologists because the universities pay three or four times more than industrial laboratories, according to a recent article in Ekonomicheskaya Gazeta. This is the reverse of the situation generally encountered in the U. S. This article is one of 10 from recent USSR publications which have been translated and are available from the Commerce Department, Office of Technical Services, Washington 25, D. C. Ask for "Administration and Organization of Soviet Science," No. 61-31508. Price is 75 cents.

▶ **Corning Meets Minuteman Goal**—Corning Glass Works has become the first of 13 contractors under North American Autonetics Division's high reliability component program to achieve specified goal. Corning's fixed glass capacitors have shown a reliability factor of 99.9994% during 1,000 operating hours, with a 60% confidence level. Expressed another way, out of one million such capacitors, only six can fail. Autonetics says this represents a 100-fold improvement over reliability of standard military type capacitors available two years ago when the company's program was launched.

▶ **Raytheon Offers to Buy Cossor**—Raytheon has moved to expand its European market participation with an offer of approximately $6 million for the purchase of all stock of A. C. Cossor, Ltd., British manufacturer of radio, radar and electronics. Company, which had sales of $17 million last year, employs about 2,500 people.

▶ **Western Electronics Expands**—Electronic firms in 11 western states accounted for 24.2% of the nation's electronic production in 1960, up slightly from previous year's 22% according to figures released by Western Electronic Manufacturers Assn. Western electronic industry share for 1961 is estimated at 24.9%. The greater Los Angeles area accounted for half of the 1960 Western sales of $2.8 billion. Arizona showed the greatest sales gain, however, with an increase of 44% over 1959, according to WEMA. More than half the Western firms are privately owned and less than 10 years old, according to a WEMA survey. Less than 25% of today's firms were in existence 15 years ago, survey indicates.

▶ **Westinghouse Develops New Molectronic Unit**—Molecular-electronic device which can be used for multiplication or division, with an accuracy of about 5%, has been announced by Westinghouse Electric. The device, consisting of a solid slice of silicon about the size of a thumbtack head, has an input range of 10:1 and an output range of 100:1, company reports.



**Lunar Radiometer**

**Lunar radiometer, which will measure temperature gradient of moon's crust down to a depth of 3 ft., will be one of several instruments to measure subsurface lunar characteristics. One-inch diameter radiometer, made by Minneapolis-Honeywell for Texaco Laboratories, will be stacked with other instruments in a probe which is to be inserted into a 1¼-in.-diameter hole that Surveyor soft-landed space vehicle will drill in moon's surface. Radiometer employs thermocouple for sensing temperature changes. Texaco holds contract from Jet Propulsion Laboratory (AW July 3, p. 62) for instruments to measure surface and subsurface physical properties of moon.**

# FINANCIAL

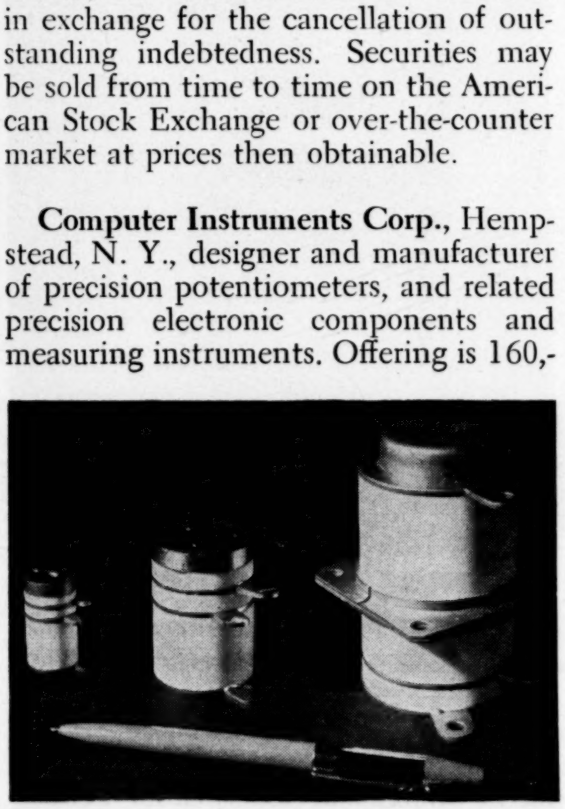
## New Offerings

**Industrial Electronic Hardware Corp.,** New York, N. Y., manufacturers of basic component parts for electrical and electronic equipment, including ground and airborne communication equipment. Offering is $1,000,000 of 6% convertible subordinated debentures, due 1976, and 25,000 common shares by the present holder. Of the proceeds, $250,000 will be used for expansion of the company's connector business; $150,000 for tooling up and production of radiac detector dosimeters; the balance to finance the initial inventory and introduction of the Brimar, Ltd., line. The company is negotiating to become the exclusive U. S. distributor for Brimar, Ltd., receiving tubes and test equipment tubes.

**Semicon, Inc.,** Bedford, Mass., manufacturer of semiconductors. Offering is 125,000 Class A common shares at $4 per share. Of the proceeds, $200,000 will be used for development of new products; $75,000 for expansion of manufacturing facilities; $30,000 for purchase or lease of new equipment.

**Seaboard World Airlines, Inc.,** Jamaica, N. Y., cargo carrier. Offering is 247,904 common shares to creditors in exchange for the cancellation of outstanding indebtedness. Securities may be sold from time to time on the American Stock Exchange or over-the-counter market at prices then obtainable.

**Computer Instruments Corp.,** Hempstead, N. Y., designer and manufacturer of precision potentiometers, and related precision electronic components and measuring instruments. Offering is 160,000 outstanding shares by the present holders.



### New Diodes

**Three new high temperature diodes, which can operate continuously at temperatures up to 500C, are now available in sample quantities from General Electric's Power Tube Dept., Schenectady, N.Y. The ceramic diodes, with current ratings ranging from 0.15 to 10 amp., have been successfully operated for 1,000 hr. at 400C, GE says.**

**Yardney Electric Corp.,** New York, N. Y., engaged in development, design and manufacture of silver-zinc primary and rechargeable batteries, and silver-cadmium rechargeable batteries. Offering is 200,000 common shares. Of the proceeds, $1,250,000 will be used for additional equipment in the recently acquired Stonington, Conn., plant; $500,000 to purchase machinery and equipment needed for the development and production of new products; $250,000 may be used to pay the balance of the purchase price of the Stonington property if the company decides not to exercise its option to sell and lease back that property.

**Pioneer Astro Industries, Inc.,** Chicago, Ill., (formerly Pioneer Tool and Engineering Co.) develops and produces precision-machined components and assemblies for guidance systems and other astro-instrumentation of missiles and space vehicles. Offering is 150,000 common shares. Of the proceeds, $750,000 will be used in connection with the proposed construction and operation of a plant in California, and the balance for additional equipment and working capital in the Chicago plant.

**Cramer Electronics, Inc.,** Boston, Mass., distributor of electronic components and equipment in the New England area. Offering is 150,000 common shares; 107,250 for public sale by the company, and 42,750 outstanding shares by the present holders. Of the proceeds of the company sale, $445,000 will be used to retire bank indebtedness; $100,000 will be used to purchase office and warehouse equipment at several locations and to discharge obligations assumed in the acquisition of one location.

**Zep Aero,** El Segundo, Calif., engaged in research, engineering, development and manufacture of oxygen systems and accessories used in business aircraft, jet transports and other pressurized aircraft. Offering is 50,000 common shares; 30,000 for public sale by the company, and 20,000 by Wilbur J. Zepp, founder, president and board chairman. Proceeds will be used to increase inventory ($100,000), and for plant improvement and acquisition of additional production equipment for facilities in El Segundo and Denver ($120,000).

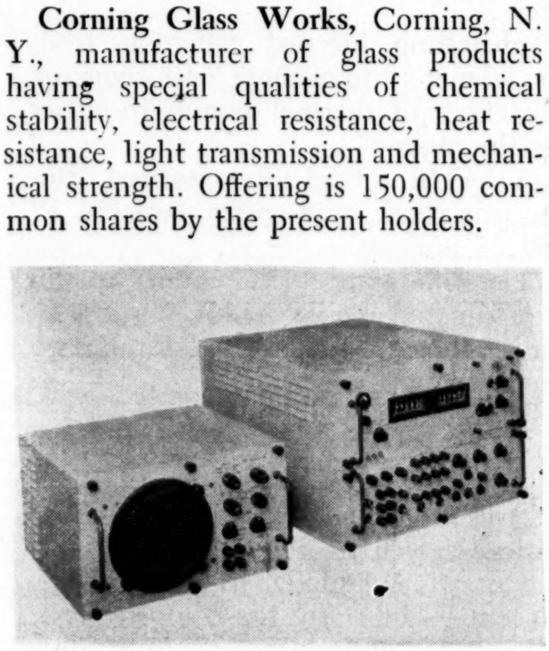
**Electro-Tec Corp.,** South Hackensack, N. J., engaged in the design, development and manufacture of slip ring and brush lock assemblies, switching devices and relays for electronic equipment. Offering is 91,000 outstanding common shares.

**Magnetic Metals Co.,** Camden, N. J., engaged in the development and manufacture of magnetic components which serve basic needs in the electrical and electronics industries. Offering is 151,200 outstanding common shares.

**American Micro Devices, Inc.,** Phoenix, Ariz.; organized in May, 1961, company proposes to engage in the solid state electronic component industry, including research, development, design and manufacture of electronic devices and components. Offering is 1,500,000 Class A common shares at $1.15 per share. Of the proceeds, $250,000 will be used for the purchase of capital equipment needed in a proposed plant; $150,000 for materials for production and inventory; $650,000 for expenses of operating the plant.

**Marshall Industries,** San Marino, Calif., engaged in research, development, design and manufacture of electronic components and instruments for use in space and missile applications. Offering is 131,305 common shares to common stockholders at the rate of one new share for each four shares held. The company plans to use $500,000 of the proceeds in its divisions, and a similar amount will be loaned to its subsidiaries.

**Corning Glass Works,** Corning, N. Y., manufacturer of glass products having special qualities of chemical stability, electrical resistance, heat resistance, light transmission and mechanical strength. Offering is 150,000 common shares by the present holders.



### Loran-C Receiver

**Transistorized Loran-C receiver for precision navigation is now available in commercial model (right) similar to AN/SPN-30 being produced for the Coast Guard. Unit at left is an indicator for displaying Loran-C signals and serves as a test oscilloscope for receiver. Manufacturer: Collins Radio Co., Box 1891, Dallas, Tex.**

# WHO'S WHERE

(*Continued from page 23*)

## Changes

**David E. Trumbull**, manager-marketing, General Electric Co.'s Tempo operation, Santa Barbara, Calif., succeeding **Russell E. Paulding** who assumes marketing responsibilities for the Information and Control Systems Section of GE's Defense Systems Department, Syracuse, N. Y.

**Robert W. Kluge**, director-special defense program, The Martin Co.'s Orlando (Fla.) Division. Also: **Sidney Stark**, director-advanced systems; **Herman R. Staudt**, director-Pershing ballistic missile system program.

**W. Lewis Whittier**, deputy general manager, Aircraft Division, Douglas Aircraft Company, Inc., Long Beach, Calif. Other appointments: **Harold E. Showalter**, controller; **James W. Ross**, assistant general manager-contracts; **J. O. Moxness**, director and general commercial sales manager; **James B. Edwards**, director-international commercial sales; **James S. Farra**, director-domestic commercial sales; **A. V. Guillou**, director-military relations and assistant to the vice president-general manager for plans; **Leo J. Devlin**, director-engineering and product development; **Charles R. Strang**, deputy director and chief engineer-transport aircraft engineering.

**Arthur P. Hill**, formerly assistant to the president of Mitre Corp., named director of Philco advanced systems at the new Burlington, Mass. facility.

**Eugene S. Rehrig**, manager of the Washington (D. C.) Regional Office for Laboratory for Electronics, Inc.

**Peter V. Cerar**, East Coast regional director of military marketing, American Bosch Arma Corp., Garden City, N. Y.

**Frank D. Covely**, special projects manager, Hughes Aircraft Co.'s Communications Division, Culver City, Calif.

**Francis M. McDermott**, formerly executive director of the Air Traffic Control Assn., is now an independent consultant on air safety issues and has been retained by Systems Development Corp. and Cubic Corp.

**Dr. Neal Zierler** has joined Arcon Corp., Lexington, Mass., and **Dr. Robert W. Sittler** has been appointed technical director.

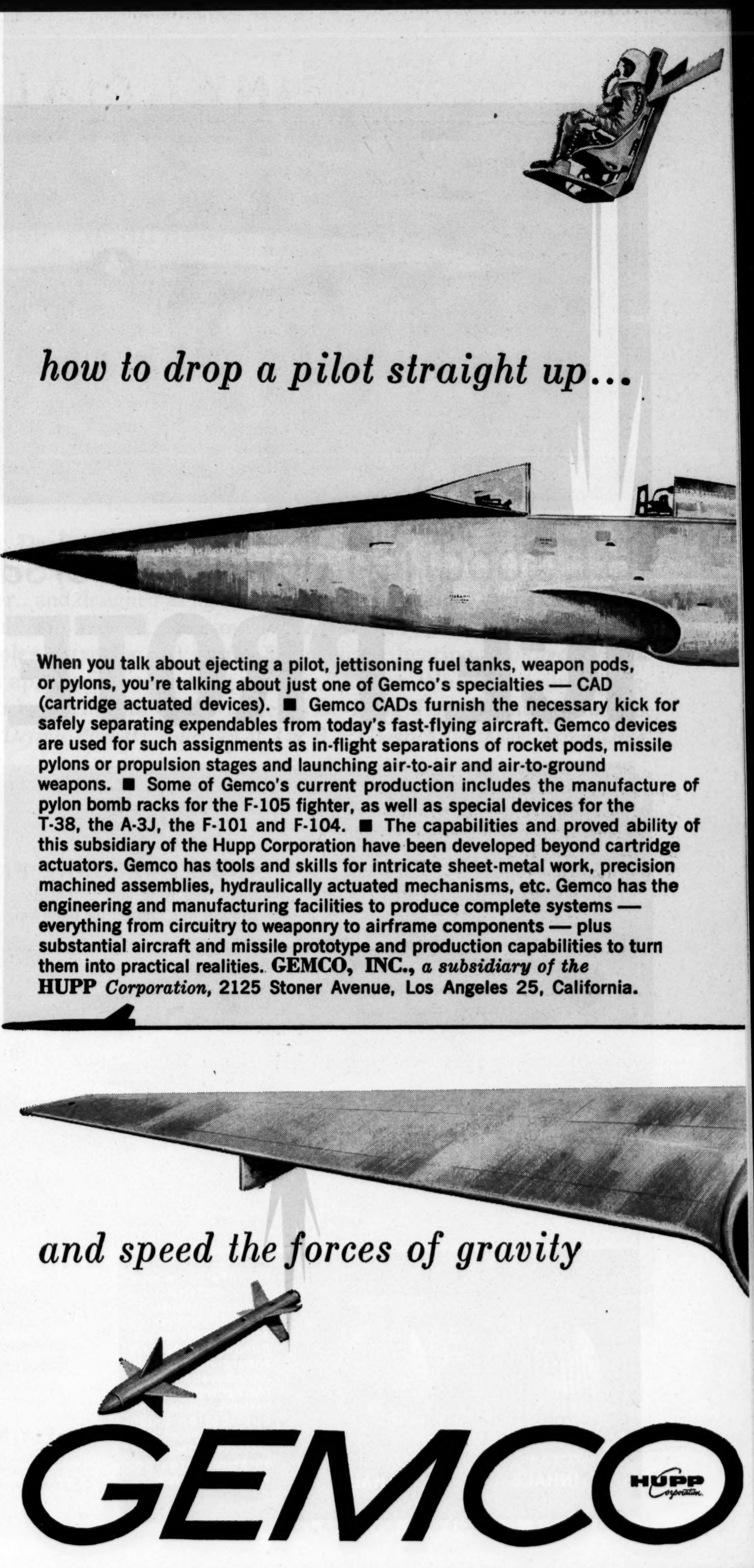
**John Park**, manager, Data Support Planning, Pan American's Guided Missiles Range Division, Patrick AFB, Fla., and **Donald E. Boren**, manager, Data Acquisitions Planning.

**Thomas H. Taylor**, manager-liaison activities, Aeronautical Radio, Inc., Washington, D. C., succeeding **Walter W. Broomall**, deceased.

**Maurice H. McGuire**, general sales manager, Hydro-Aire Co., Burbank, Calif.

**Edward M. Cattarin**, head, New Product Engineering Department, Airborne Controls, Inc., Sun Valley, Calif.

Trans-Texas Airways has announced the following appointments: **J. Marvin Brooks**, director of training, Operations-Planning Division; **J. L. Herring**, director of properties and facilities; **W. W. Franklin**, supervisor of stations; **T. O. Brinkley**, head of line communications; **J. A. Martin**, in charge of the the Passenger Service Department; **C. H. Rodgers**, manager of tariffs; **George Barbier**, manager of schedules; **Charles L. Baker**, director of maintenance and engineering.



*how to drop a pilot straight up...*

When you talk about ejecting a pilot, jettisoning fuel tanks, weapon pods, or pylons, you're talking about just one of Gemco's specialties — CAD (cartridge actuated devices). ■ Gemco CADs furnish the necessary kick for safely separating expendables from today's fast-flying aircraft. Gemco devices are used for such assignments as in-flight separations of rocket pods, missile pylons or propulsion stages and launching air-to-air and air-to-ground weapons. ■ Some of Gemco's current production includes the manufacture of pylon bomb racks for the F-105 fighter, as well as special devices for the T-38, the A-3J, the F-101 and F-104. ■ The capabilities and proved ability of this subsidiary of the Hupp Corporation have been developed beyond cartridge actuators. Gemco has tools and skills for intricate sheet-metal work, precision machined assemblies, hydraulically actuated mechanisms, etc. Gemco has the engineering and manufacturing facilities to produce complete systems — everything from circuitry to weaponry to airframe components — plus substantial aircraft and missile prototype and production capabilities to turn them into practical realities. **GEMCO, INC.,** ***a subsidiary of the*** **HUPP** ***Corporation,*** **2125 Stoner Avenue, Los Angeles 25, California.**

*and speed the forces of gravity*

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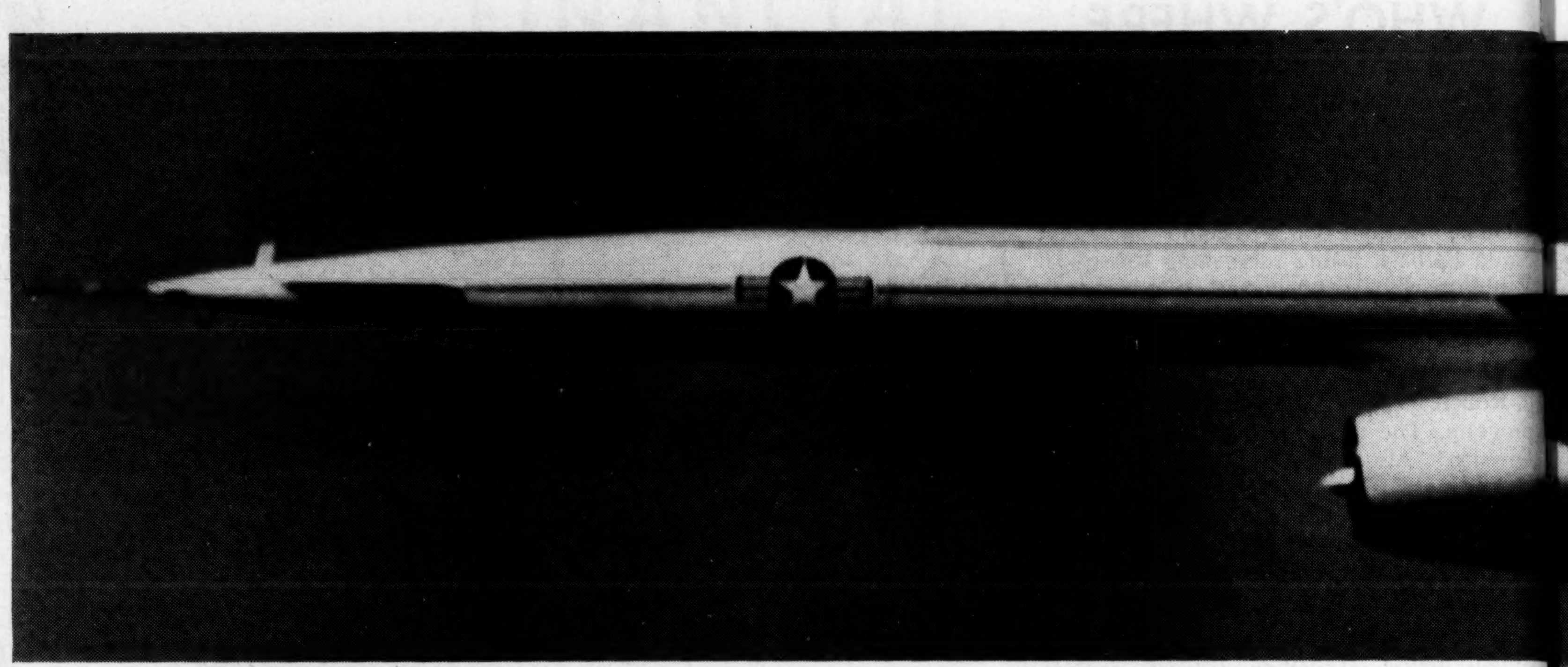

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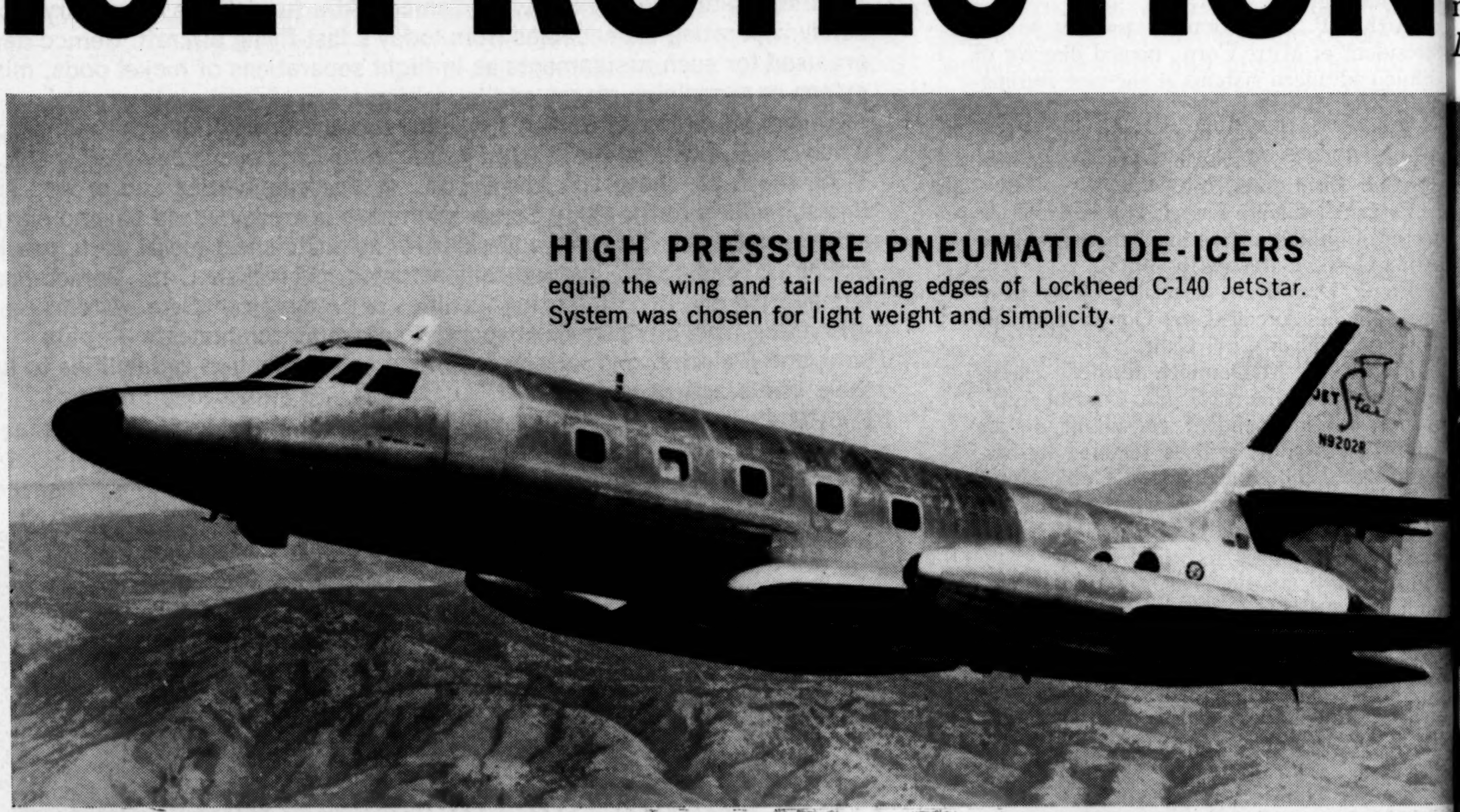
## B.F.Goodrich develops versatile systems for

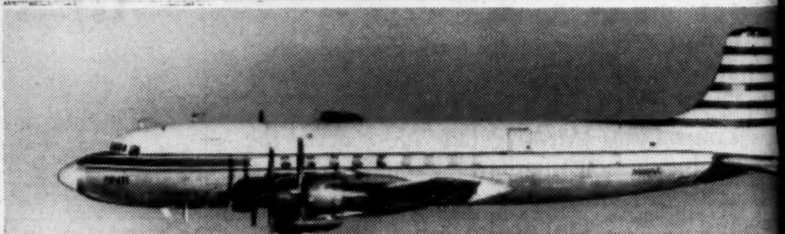
# ICE PROTECTION



**HIGH PRESSURE PNEUMATIC DE-ICERS** equip the wing and tail leading edges of Lockheed C-140 JetStar. System was chosen for light weight and simplicity.

INHALE
EXHALE

Pneumatic De-Icers on nose radome cause minimum signal interference. Flexing action breaks up ice. Pneumatic De-Icers assure dependable ice removal, and make the lightest effective systems. On radome application tough hide of De-Icer also protects surface from abrasion, erosion, and hail damage.

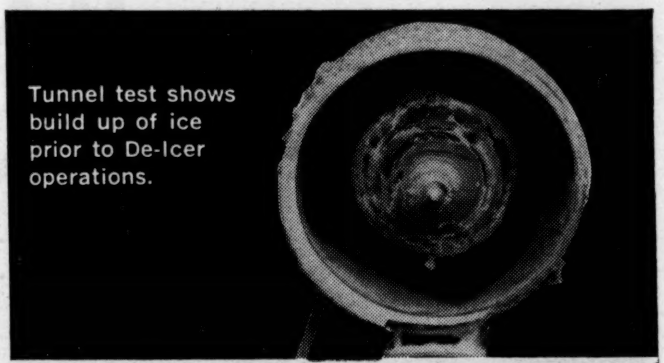


**FLYING TV ANTENNA** is kept ice-free on this specially equipped DC-6AB used for educational broad-casts. Two pneumatic De-Icers cover the leading edge of the 23-foot antenna. Pressure is cycled in spanwise tubes.

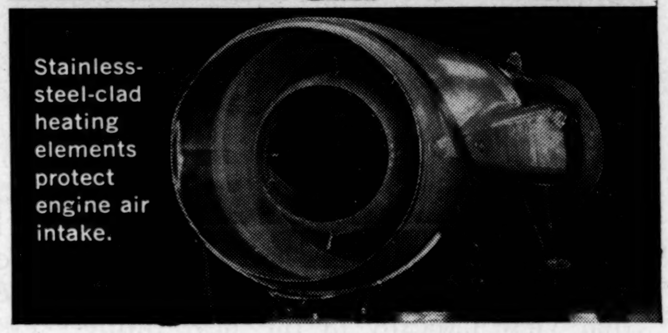
## ELECTRO-THERMAL DE-ICER SYSTEMS KEEP "HOUND DOG" NOSE WARM

To keep this North American Aviation missile's engine ready for instant launching despite freezing conditions, BFG electro-thermal units are installed on the nose cone, supporting struts and ram air probes.

USAF
XGAM-77
019



Tunnel test shows build up of ice prior to De-Icer operations.



Stainless-steel-clad heating elements protect engine air intake.

Since introducing the first pneumatic De-Icers for aircraft over thirty years ago, B.F.Goodrich has developed a broad capability in ice protection systems: *Pneumatic De-Icers* are used on high performance aircraft like the Lockheed C-140 JetStar...and designed as lightweight systems for small twins. *Metal Clad Electro-Thermal De-Icers* can be adapted to airfoil shapes, and in many cases can serve as structural members. *Heated Rubber* is adaptable to fit complex curves or odd shapes for localized heating. *Reinforced plastic parts*, integrally heated, are available for applications not subject to severe abrasion. Whatever your requirements in eliminating or controlling ice bring them to BFG...the leader in De-Icing. For information contact *Dept. AW-9A, B.F.Goodrich Aerospace & Defense Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

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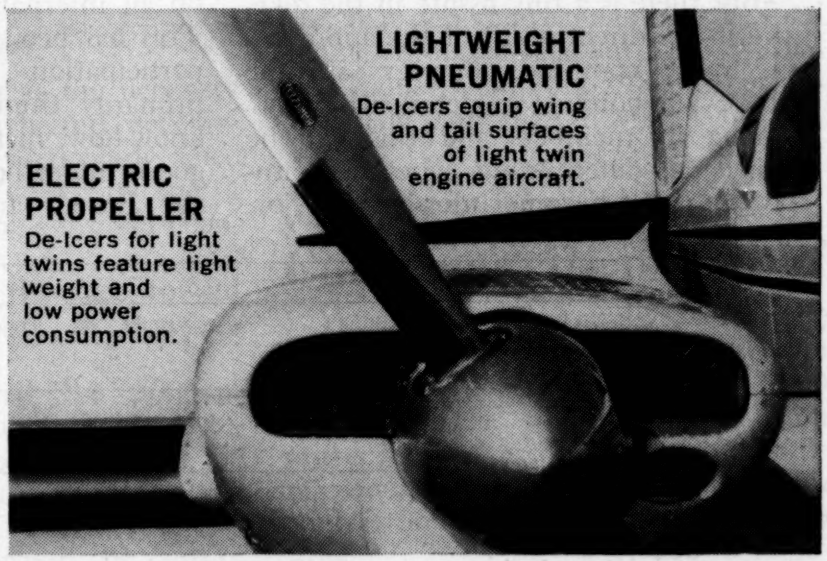
**"HAIL-SAFE" DE-ICING** is provided on empennage of General Dynamics/Convair 880 by BFG Cladheat electro-thermal De-Icers. Stainless steel skin withstands abrasion from rain, dust, even hail at high cruising speeds. Six-foot Cladheat sections are bonded to leading edges to form a smooth, integral airfoil.



**LIGHTWEIGHT PNEUMATIC** De-Icers equip wing and tail surfaces of light twin engine aircraft.

**ELECTRIC PROPELLER** De-Icers for light twins feature light weight and low power consumption.

PULL TO OPEN

**HEATED RUBBER** bonds securely to complex curves and odd shapes as well as flat surfaces. Integral electrical heating elements control ice formation in areas such as air intakes and cowls, or provide heating for power units.

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# MANAGEMENT

# Farnborough to Remain All-British Show

By Herbert J. Coleman

**London**—Britain's aviation industry, despite a concerted effort to move deeper into the international aerospace market, will keep its traditional showcase—the annual Farnborough Air Show—a purely British effort for the foreseeable future.

But the trend toward deeper penetration of the aerospace market, admittedly cautious and tentative in the space field at the moment, may change that view radically in the near future when Britain joins other European nations in a joint space venture.

Edward Bowyer, chief executive and director of the Society of British Aircraft Constructors, the Farnborough sponsor, says his organization is inclined toward a pragmatic view—to keep the display British and resist side-by-side competition which would come from foreign countries.

## Space Program Factor

But there is a tiny fissure in the dike, and it is a direct result of the approaching space combine. Bowyer said the SBAC will conduct a "detailed inquiry" among its members and this will be aimed at determining whether Farnborough will become international "or, at any rate, a limited international show."

The definition of "limited" inclines toward the view that the SBAC may finally admit Commonwealth countries, such as Canada and Australia, into the show. Another factor is that Britain is gradually moving toward participation in the European Common Market as a full partner.

It's all far from settled—still really in the conversational stage—but it reflects the reaction to past criticism that the Farnborough show can provide little radically new in a single 12-month hiatus.

Bowyer, obviously, does not agree with this. Says he: "It's a poor kind of show where you only display prototypes and mockups. Of course we show airplanes that have appeared in the past, but they are improved versions and the improvements themselves are of interest."

Besides, Bowyer continued, Farnborough in the past few years has taken on an international tinge despite itself. This has been due to increased foreign participation in British companies, primarily through U. S. financing and know-how, in the production of foreign goods under license. At the same time, the British aviation industry has expanded its license agreements with manufacturers in various foreign nations.

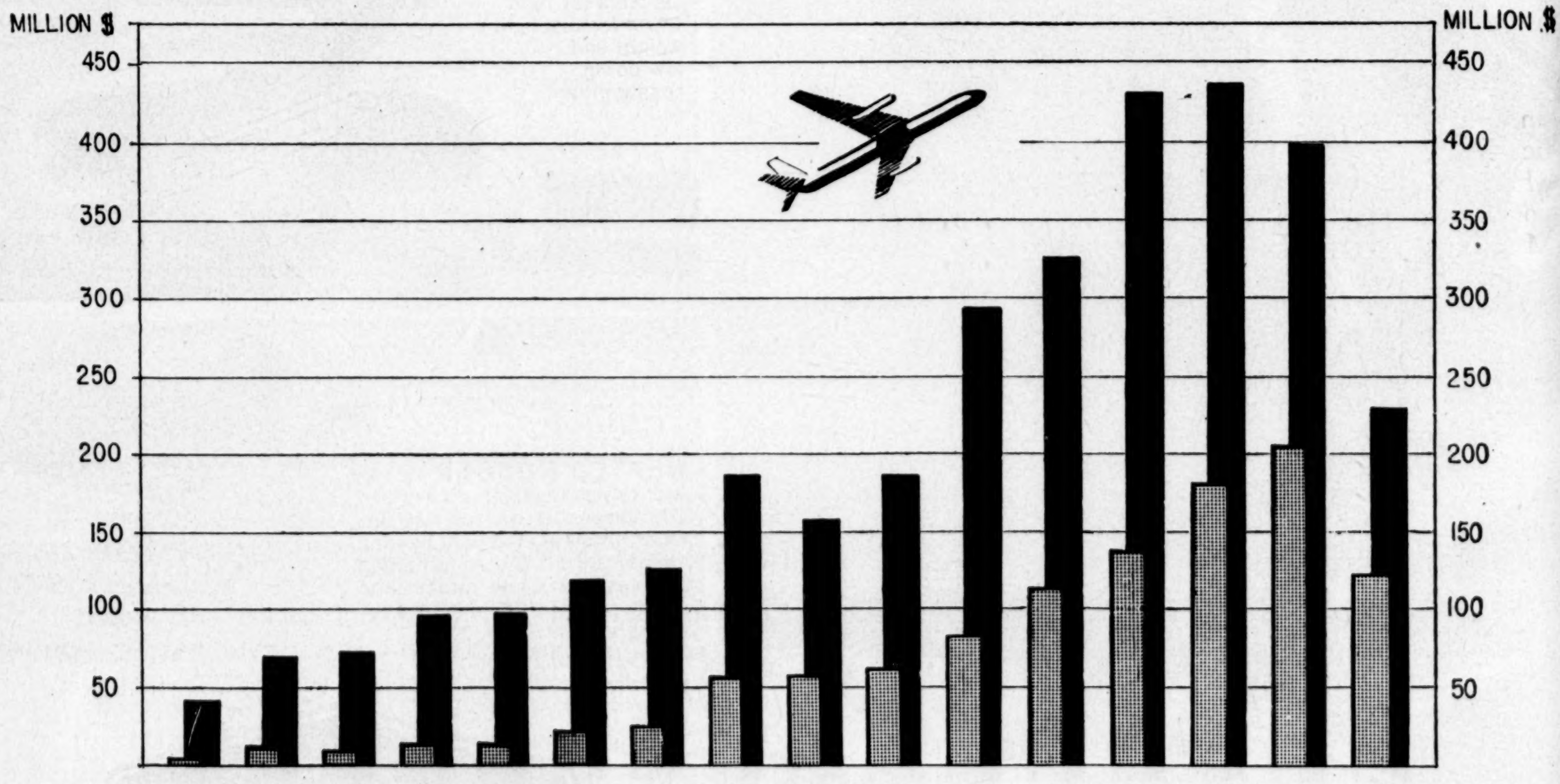
At any rate, Bowyer replies to criticism that the demand for Farnborough space this year is greater than ever before. Main exhibition building has had to be enlarged and the equipment park is 25% larger than last year. There will be about 400 stands when the show opens Sept. 4.

## Newest Planes Missing

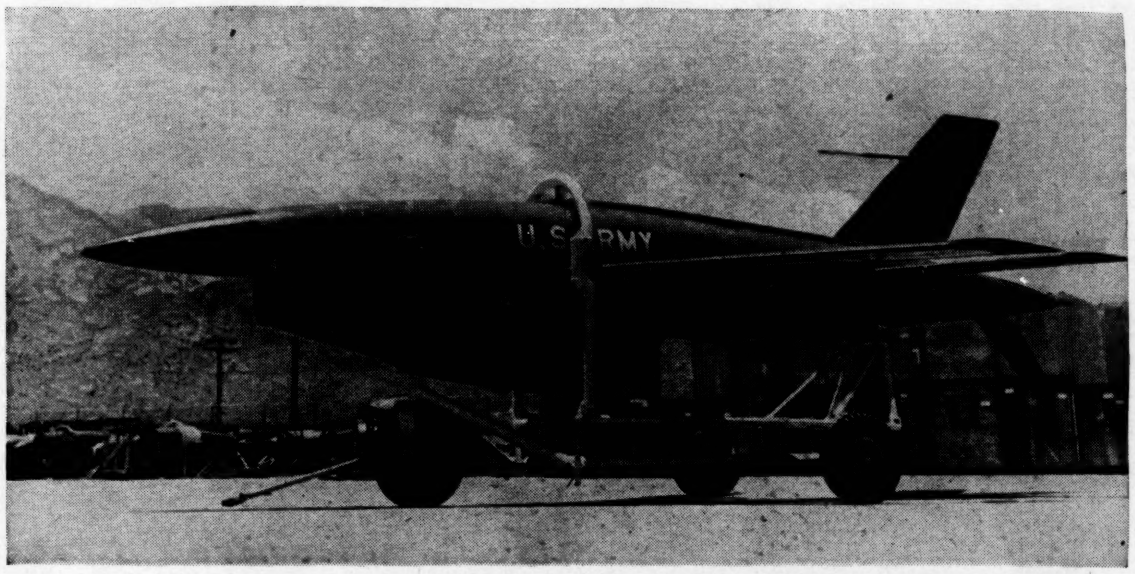
Still, the air will be dominated by the Royal Air Force flyby and the airplanes which normally would draw intense interest will be far from the scene. For instance, the Bristol T.188 stainless steel Mach 2 research plane has rolled out and has not yet flown. The British Aircraft Corp.'s TSR.2 tactical strike fighter is on the jigs at English Electric and Vickers-Armstrongs and probably won't be shown even in model form.

Hawker Siddeley's two P.1127 VTOL fighters are deeply involved in the company test program and may not participate at all. The Handley Page slim delta research plane has just made its first flight.

In the transport field, the de Haviland Trident recently rolled out and



**IMPORTANCE** of aeronautical engines to the British aircraft industry's export market is illustrated in this chart prepared by the Society of British Aircraft Constructors. Peak year of 1959 was due to heavy sales of Vickers Viscounts, Hawker Hunters and English Electric Canberras. The Hunters, for instance, were sold to 11 air forces for about $5.6 million.



## Army Orders Firebee Missile Targets

**Ryan Firebee turbojet-powered missile target in Army markings is a Model 124-E, a version of the Q-2C drone. Ryan Aeronautical Co. is delivering the 124-Es to White Sands Missile Range, N. M., for use in Army surface-to-air missile launching training. Army launches Firebee from a zero-length launcher.**

won't fly until winter. The Vickers VC.10 and BAC 111 are on the production lines, as is the Short SC.5 Belfast turboprop for RAF. The de Havilland Jet Dragon twin-jet executive transport will be shown in model form (the mockup is still under construction at Hatfield). An Argosy 660, the version for RAF, will be shown.

That leaves the new plane field to Beagle, the Pressed Steel Co., Ltd.'s business aviation arm, which has timed the unveiling of its new Beagle 206 light twin for the Farnborough show, as it previously timed its single-engine Airedale for the Shackleton display at Coventry last April.

### Blue Streak

The missile field will be dominated by Blue Streak, prime mover in the forthcoming British space effort. The newest missile, Red Top, a follow-on to Firestreak, probably won't be shown because of security restrictions. The other major weapons—Bloodhound, Vigilant, Seacat, Sea Slug and Blue Water—have been shown before, in mockups and hardware form.

Of primary interest in the aero engine field will be the Rolls-Royce and Bristol Siddeley vertical lift engines which promise to become an important export factor. Rolls also will show its RCo.42 Conway bypass engine for the first time.

A feature of this year's display, Bowyer said, will be the visual presentation of the results of grouping Britain's aircraft industry, an internal movement still not yet completed. He calls it an inevitable reflection of "living in the day of the big units," and adds:

"Grouping has been a strengthening force, undertaken with exceptional smoothness," despite considerable skepticism (and Bowyer admits to some) when the amalgamation was first proposed to the industry by the then Minister of Aviation, Duncan Sandys.

On the other hand, Bowyer thinks Britain should keep its aero engine effort in two engine companies—Rolls-Royce, which recently acquired Napier Engines, and Bristol Siddeley—on the grounds that "one must not have all the eggs in one basket." But, asked how Westland Aircraft, the lone helicopter manufacturer, fitted into this line of reasoning, Bowyer replied: "That's the English for you."

### Jet Lift Field

He forecast a "considerable" impact abroad in the jet lift field (the U. S. already has a hefty investment in the Bristol Siddeley BS.53 Pegasus), pointing out that Rolls-Royce has kept its emphasis on the small lift engines, while Bristol Siddeley emphasizes the large lift engines.

He considers the British aircraft industry in a healthy stage, with a high employment and export factor, but said there is a need for aggressive sales to keep it healthy.

"The Russians have it made," he said. "They just tell their people what way the economy will go. A democracy, of course, can't do this. But the Americans constantly are salesmen for their country and its products and we could use some of this."

### Supersonic Transport

Of equal importance is the necessity to keep British research and development at a high peak, particularly since the aviation industry's exports are a vital point in the nation's over-all economy.

And this includes the race toward the supersonic transport, in Bowyer's opinion.

Bowyer is convinced the program must go forward, although he bends toward caution "because we cannot be allowed to starve developments in the subsonic field."

The supersonic transport, he continued, is the logical development toward better, cheaper, faster mass transportation, and like the jet transport, brings with it tremendous problems, such as the sonic boom.

In addition, the question of financing is paramount and Bowyer believes Britain can build the supersonic transport only with extensive government aid. The trend toward this has already started, with talks under way between the Royal Aircraft Establishment, French Ministry of Transport, Sud Aviation and British Aircraft Corp. as the possible manufacturers. (AW July 24, p. 23).

Turning to a less striking, but important, field of endeavor—business flying—Bowyer doubts that Britain itself can ever be a big market because of its two major roadblocks—weather and congested airways. But the British effort is growing, in spite of apparent resistance on a government level, and should be a force to reckon with in a few years, Bowyer contended, in the export field if not heavily at home.

The exports, boosted sharply by the aero engine manufacturers, have been worth about $232 million in the first six months of this year, up $15 million over that period a year ago. Of the total, engines brought in about $125 million. The industry employs 298,400 persons, or 14,100 more than in May, 1960.

## Military Maintenance Contracts 'Reasonable'

**Washington**—Testimony by representatives of the three military services has satisfied members of the House Armed Services Investigating Subcommittee that a reasonable balance is being maintained between in-house and contractor operations and maintenance work.

Joseph S. Imirie, assistant secretary of Air Force for materiel, told the subcommittee USAF's goal is to perform "all combat and direct combat support functions with in-house capability"—and contract out for indirect combat functions where this will result in improved effectiveness or greater economy. He said that due to a shortage of skilled personnel, USAF has contracted out "more than we would have preferred, particularly in the electronics field," but is now in the process of correcting the situation.

As an example, Imirie noted that USAF is now manning SAGE powerplants and computers and the Aleutian segment of DEW Line with its own personnel.

Kenneth E. Be Lieu, assistant secre-

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tary of Navy for installations and logistics, said Navy's policy is to keep "a representative capability in-house for nearly every type of maintenance necessary to keep in readiness its ships, aircraft, and associated weapons." Navy will continue to contract out for maintenance work on missile components that involve test facilities available in contractor plants, and for aircraft with commercial counterparts which can be more cheaply overhauled in contractor plants, Be Lieu said.

Maj. Gen. William B. Bunker, commander of Army's Transportation Materiel Command, reported that the "major portion" of Army aircraft, engine and components maintenance has been and will continue to be performed on a contract basis, but that Army is reactivating an installation at Corpus Christi, Tex., which will be "capable of overhaul and repair of the full range but not the full quantity of mission-essential aeronautical materiel." Rehabilitation of the Corpus Christi installation, built by Navy at a cost of $23 million, started in July. It will cost an estimated $700,000.

Bunker reported that in Fiscal 1961, Army spent $4 million on in-house maintenance of its aviation equipment compared with $20.7 million in contractor maintenance.

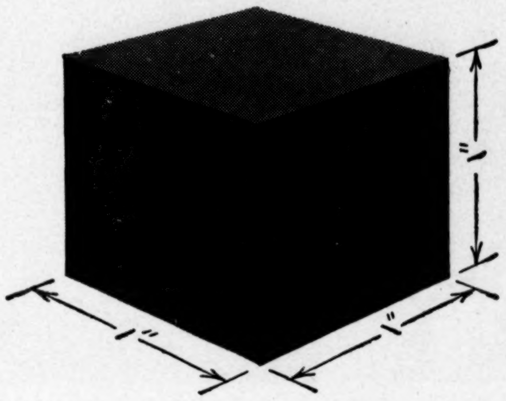
Imirie reported these payments for contractor-operator USAF facilities in Fiscal 1961:

- **Pan American World Airways,** Atlantic Missile Range, Florida, $88.8 million.
- **Aro, Inc.,** Arnold Engineering Development Center, Tullohoma, Tenn., $25.3 million.
- **Vitro Corp., of America,** Eglin Gulf Test Range, Florida, $7.9 million
- **Coleman Engineering Co.,** Edwards Air Force Base, $1.7 million.
- **Tumpane Co., Turkey,** $4.4 million.
- **Vinnell Corp.,** Saudi Arabia, $1.4 million.
- **Federal Electric Corp.,** DEW Line, $41.2 million.
- **Radio Corp. of America,** White Alice communications system, Alaska, $11.8 million.
- **Radio Corp. of America,** BMEWS, $47 million.
- **Royal Canadian Air Force,** Pine Tree sites, $3.7 million.

Imirie also reported these payments for contractor operation of USAF air defense systems:

- **Vinnell Corp.,** $1.1 million.
- **Vitro Corp. of America,** $1.4 million.
- **M & T Co.,** $759,000.
- **American Hydrotherm Corp.,** $610,000.
- **RCA Service Co.,** $1.2 million
- **System Development Corp.,** $30.7 million.
- **Western Electric Co.,** $19.4 million.

# BREAKTHROUGH!



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Here's a revolutionary new timing device from Honeywell. The basic module is a single low pulse rate magnetic oscillator with periods of 1/100 second up to five seconds. Countdown circuitry provides any time extension.

Specifications include accuracies of better than 0.05% over a temperature range of −65° to +125° F. with supply voltage variations ±10%. Oscillator power requirements are 8 ma at 6 vdc, and the timer is available with fixed or variable time periods and single or multiple outputs, depending upon requirements.

*The timer's use of a magnetic core oscillator instead of other devices insures exceptional long term stability.*

Rugged enough for gun-fired projectiles, the new Honeywell timer is excellent for military applications like safing, arming, fuzing and programming mines, torpedoes, missiles, satellites and other mechanisms.

Size of the timer depends upon the time interval desired and packaging requirements. The five-second module occupies only one cubic inch. Each additional decade counter stage requires another cubic inch.

Highly reliable, with a long shelf life, this new timer represents a remarkable design breakthrough. For further information write Honeywell Military Products Group, 600 Second St. No., Hopkins, Minn.

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**U. S. AIR FORCE** North American F-100 (foreground), McDonnell F-101 reconnaissance aircraft and Republic F-84s on the maintenance and modification line at Chateauroux in a facility managed and staffed by S.E.R.I.M.A., an indirect subsidiary of Sud Aviation. S.E.R.I.M.A. is one of a number of European firms maintaining USAF aircraft and engines under contract.

# Europeans to Keep USAF Overhaul Work

By Cecil Brownlow

**Chateauroux**—Federal gold flow directives will have little impact upon U. S. Air Force maintenance and modification contracts in Western Europe because of the substantial sacrifices in time, money and technical talent any major reverse work flow to North America would entail.

At the moment, approximately 95% of the maintenance of all USAF airframes operationally assigned to this theater is carried out by European firms, and the percentage may climb nearer to 100% before the end of the current fiscal year. Turbojet maintenance projects probably also will be retained in Europe.

## Cost Difference

Some piston-engine work, however, is being shunted back to the U. S. since the cost difference falls within the framework of the new federal gold flow directives stipulating that projects that can be handled in the U. S. at an additional price of not more than 25% should be returned there whenever possible rather than contracted overseas. Basic goal of the directives, which touch upon a number of areas, is to stem the general tide that has been flushing dollars from the U. S. and into foreign treasuries at a rate that has been above normal.

Otherwise, in the aircraft category, work can be contracted here for prices ranging from almost one-sixth to approximately one-half the cost of what it would be in the U. S. In terms of total cost per direct labor hour and without any consideration of the inventory losses such shifts would entail, a factor that becomes more vital as tensions surrounding the Berlin crisis increase.

At present, these maintenance and modification programs within Europe, coupled with those of American-financed Mutual Aid commitments in the area, are big business for the firms involved, totaling about $41 million in Fiscal 1961, and consume a large share of the time and effort of the Air Materiel Force, European Area (AMFEA), which contracts for the projects and then acts as their general management agency.

AMFEA, headquartered here and commanded by Maj. Gen. George E. Price, is an organization of many facets, including such responsibilities as supervising adequate logistic support to the United Nations' military effort in the Republic of Congo, and it acts both as an extension of the Dayton headquarters of the Air Force Logistic Command and, in a number of respects, as a transplanted stateside Air Materiel Area.

But, while its responsibilities are diverse, "modification and maintenance is where the money is," according to Gen. Price.

## Savings Cited

Savings through contracting maintenance and modification work of European-based aircraft within the theater as opposed to returning them to the U. S. for identical servicing can be, he adds, "pretty spectacular when you think in terms of direct labor overhead and management."

In the U. S., an Air Force rule of thumb in estimating cost of a direct labor hour is $6 and, Gen. Price says,

FW-872
U S AIR FORCE

**SPAIN'S** Construcciones Aeronautics S. A. (CASA) is one of the Air Force's major European contractors. In picture above, Air Force pilots are taxiing out F-100s for acceptance flights after maintenance and modification by CASA technicians. Aircraft already have been checked by Spanish company pilots. Average number of defects found by USAF pilots in CASA-modified F-100s has been 1.5 per aircraft since the program began over a year ago. None has been a "safety of flight defect."

"it's a miracle if you can ever get under it." This compares with AMFEA figures that cite a range running from a low of $1.13 in Spain to a high of $2.96 in England. Other countries include Portugal, $1.25; Italy, $1.72, and France, $2.85.

In some countries—Spain as a notable example—work can be contracted and paid for with no loss of dollars, eating up, in fact, funds that otherwise might never be used.

Using Spain as the example, the U. S. builds up large blocks of pesetas there annually—at a present rate of $10 million more a year than it can spend—in payment for technical aid and sale of surplus commodities. These funds cannot be removed from Spain but can be, and are, put to use internally in paying for such programs as AMFEA maintenance and modification contracts with Spanish firms.

### Anti-Gold Flow

In another anti-gold flow move, AMFEA is now negotiating with the Italian government to pay for work done there with surplus agricultural commodities rather than with hard cash.

In relating cost of work here as compared with that in the U. S., Gen. Price cautions that "these big spreads we're talking about are in aircraft work, and we're talking in terms of direct labor hours. We're not talking about the cost of the materials concerned. It costs something to ship them over here, but this is very small when compared with the cost of labor."

"To a reasonable degree," he adds, the comparisons also can be applied to jet engines, "but when you get to reciprocating engines, then it's tough to decide where to go."

**Generally,** the added cost of doing the work within the U. S. does not exceed the gold flow directive limitations, "assuming you have enough engines to allow you to ship by sea," and overhaul of the Pratt & Whitney R2000 already has been shifted from Europe to the U. S. Cost of other piston-engine overhaul work currently being contracted in Europe is under evaluation and also could be terminated.

Potential savings on airframe modifications are evident from an example cited by Col. George Bostwick, AMFEA deputy director and a triple ace of World War II.

Here, AMFEA received a directive from the prime Air Materiel Area concerned in the U. S. requesting that it round up 12 aging C-47 transports that had been on loan to The Netherlands and were now being returned. The directive said a total of $132,000 had been set aside for AMFEA to arrange for the transfer, inspect the aircraft and have them fitted for ferry flights back to the U. S., including the installation of additional fuel tanks. The C-47s were then to undergo major overhauls and refurbishing before being transferred once again to several friendly countries, some of them located in Africa.

"One guy here," Bostwick says, "suggested that we do the rehabilitation work over here. It would save money and eliminate the need of installing ferry tanks on aircraft that were going to end up in Africa.

"The prime AMA accepted this, and the planes are now being rehabilitated for just a few thousand dollars more than $132,000. This one idea is going to save about $700,000," Gen. Bostwick said.

European contractor for the overhaul work is Oficinas Gerias de Material Aeronautico (OGMA) Portugal's equivalent of the Air Force Logistic Command. OGMA also handles, under contract, most of the routine maintenance and overhaul of C-47 and C-54 transports based in Europe.

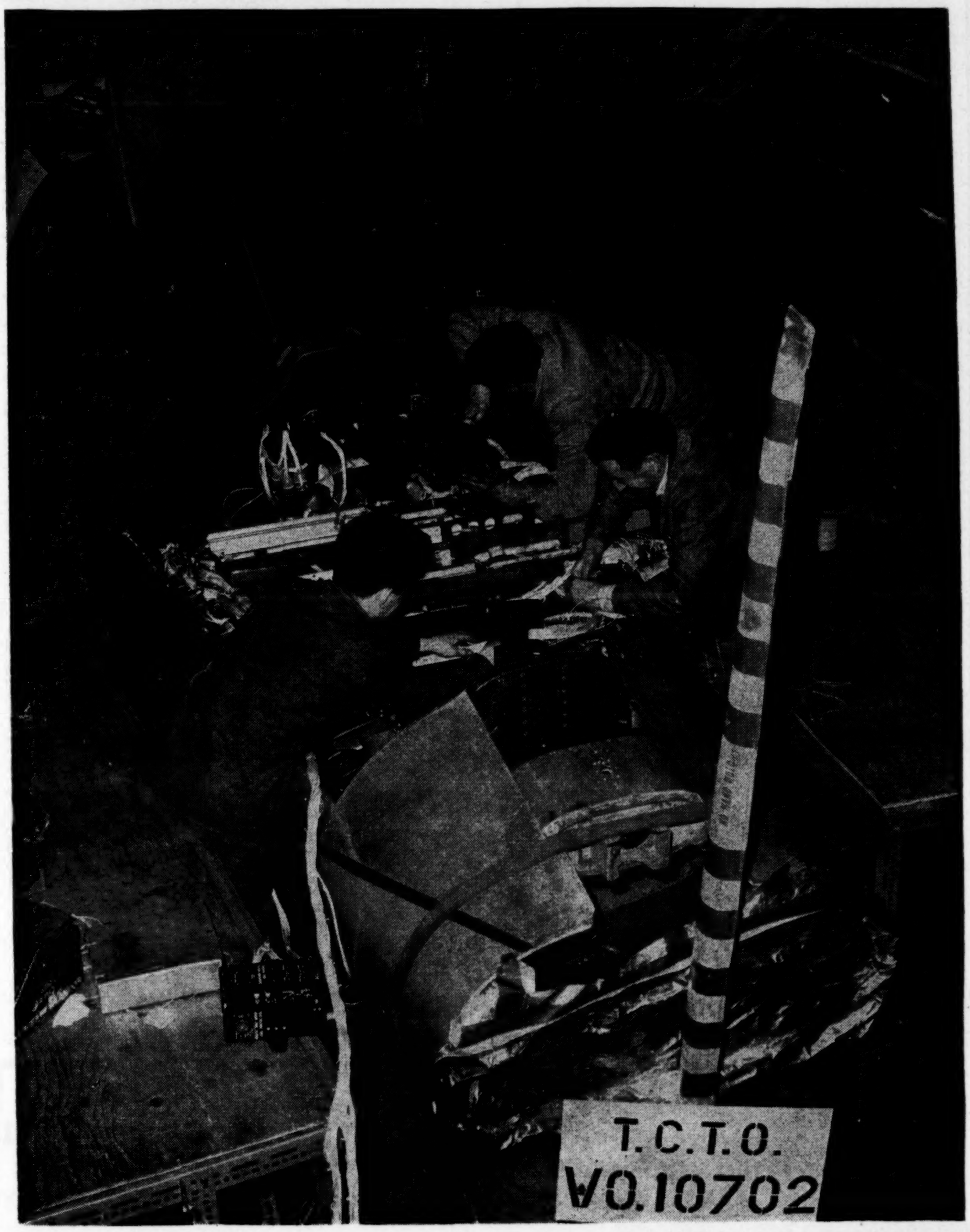
So far as the quality of work by European contractors is concerned, Gen. Price says "there's no limit to what they can do on major overhaul and modification over here. The workmanship and time needed to do the job compares favorably with that in the U. S."

### Spain's Record

As an example, he cites the record of Spain's Construcciones Aeronauticas S. A. (CASA) whose Getafe plant outside Madrid has been modifying and maintaining North American F-100 fighter-bombers at a rate of better than 40 aircraft per month for more than a year now.

Once off the line, the planes are first checked out by a CASA pilot and then by a USAF acceptance pilot. Average number of defects on the acceptance planes turned in by the Air Force pilots have been 1.5 per aircraft, and, since the program began, none of these has been a "safety of flight defect."

A similar record has been established by CASA's Saville plant which has an IRAN contract for the Lockheed T-33



**FRENCH WORKMEN** inspect the wiring of an F-100 at S.E.R.I.M.A.'s Chateauroux facility.

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jet trainers in the area. Average number of "safety of flight defects" in this program has been .03 per aircraft.

European contractors working for AMFEA who do not have company pilots to check the aircraft before they are turned over to USAF have accumulated an average of 3.0 defects per plane, .4 of them "safety of flight defects." "But this," Gen. Price concludes, "is still good any way you slice it."

The general's scope of responsibility, and the area in which he can contract, ranges wide, taking in Western Europe and Africa in one sweep and then extending eastward to the border between East Pakistan and Burma. At the Burmese border, AMFEA's eastern counterpart, Air Materiel Force, Pacific Area, takes over with a territory extending on to a point east of Guam.

### Expansive Choice

In the maintenance and modification field, Gen. Price and his officers have this expansive western slice to choose from in the selection of contractors, with their decisions hinging upon a variety of factors—need, cost, capability, practicability, political expediency geared to U. S. policy, gold flow and proximity to the operational bases of the aircraft in question, to name a few. Discussing this aspect of his job, Gen. Price says:

"All other things being equal, you normally would give it to the low bidder, but you have to inject other things in there, and then it's not necessarily equal.

"One problem, just as an example, you might not consider it advisable to put all your overhaul into one country where there might be a sudden devaluation of the currency, prolonged strikes, a change of government—you name it.

"You also have to figure in the transportation costs and the start-up costs. If, for instance, you have a man with a going facility who's done work for us and another man bids against him, the second man is at roughly a $100,000 disadvantage." This is what it would cost him in most instances to modify his facilities for Air Force programs.

"You also have to take the man's technical and management capability into consideration" Gen. Price continued.

"And, the gold flow plays a part. For instance, if somehow someone underbid Spain—say he bid $1.00 and Spain bid $1.17—you might still give it to Spain since we have those blocked pesetas down there, and working in Spain doesn't cost you anything on the gold flow."

There also, of course, are the primarily military needs of diversification of effort and the largely political require-

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ment of sharing the wealth with as many allied countries as possible. France, as an example of the latter, is host nation of AMFEA headquarters and, as such, expects and receives a commensurate share of the outflow.

As a practical matter, however, based upon the criteria of technological knowhow and proximity, AMFEA's contracts are grouped primarily in Western Europe, with a few others lightly touching the borders of North Africa and the Middle East.

Lt. Col J. L. Maher's Directorate of Procurement and Production within AMFEA is currently administering approximately 90 contracts. These include "primary" awards, those let by his office, plus approximately 16 "secondary" contracts, those portions of wide-scope USAF projects which fall within his area of responsibility. Examples of the latter include support of inter-theater communications equipment, the ballistic missile early warning system, the tropospheric scatter project and support of missile systems including the Douglas Thor IRBM and the Martin Mace and Matador tactical units.

### Secondary Contracts

Although small in number, the European portion of the secondary contracts consumes by its nature a substantially larger sum of money—$100 million at present—as compared with the $41 million for the primary awards, $24 million of which is going into a single program, Fiat G. 91 close-support fighters for the Mutual Aid countries of Turkey and Greece.

Aside from its F-100 and T-33 primary contracts, Spain's CASA also has a facility in Cadiz performing IRAN maintenance on USAF Sikorsky H-19 helicopters, while CASA Getafe is rehabilitating North American T-28 basic trainers for use by a Mutual Aid country in the AMFEA theater.

Another Spanish firm, Aeronautica Industrial S. A., is performing a portion of the work now under way for installation of tail hooks on Convair F-102 interceptors for use with a barrier emergency landing system now being adapted. Work by Portugal's OGMA includes the resealing of C-54 fuel tanks.

In France, AMFEA is currently maintaining a number of contracts, the major ones at Chateauroux-Deols, airbase portion of the sprawling USAF complex here. Here, S.E.R.I.M.A., an off-shoot and indirect subsidiary of Sud Aviation, is conducting base airframe and fire-control-system maintenance on USAF McDonnell F-101 interceptor and reconnaissance aircraft and airframe maintenance, on the F-102. Although outside AMFEA's purview, S.E.R.I.M.A. is maintaining a number of French air force F-100s. The Republic F-105 all-weather fighter-bomber, USAF's latest

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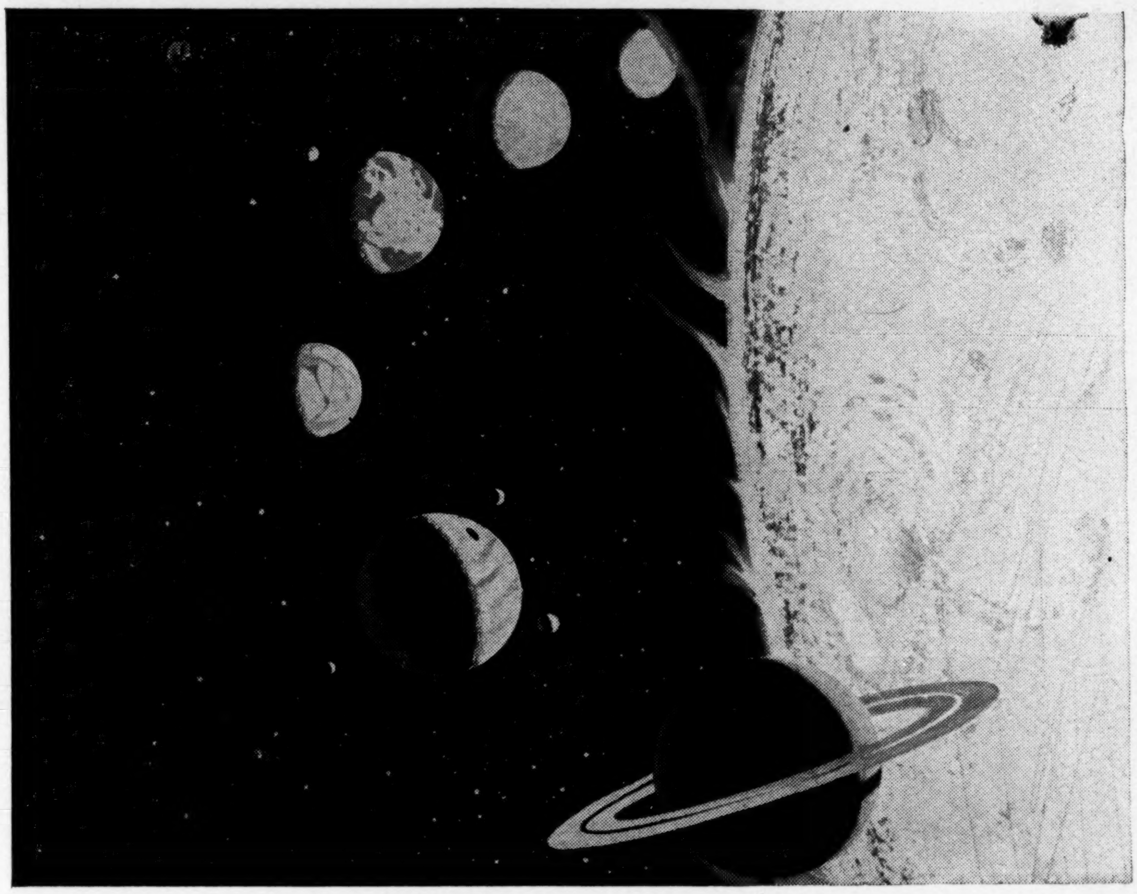
entry into the European theater, also may be serviced here as it phases into operational service.

Radio Corp. of America, acting through a French subcontractor, a mandatory feature under French law, is working here on the recalibration and repair of electronic test equipment on a theater-wide basis. Another U. S. firm, Tumpane Co., Inc., which also is working with a French subcontractor, has responsibility for repair of Air Force vehicles and aircraft ground support equipment.

### Sud Facility

In other areas, Sud's Marseille facility is renovating obsolescing Republic F-84 fighter-bombers that have been phased out of the Air Force inventory but still will be used by Mutual Aid countries, while SNECMA has a contract for the overhaul of the 17,500-lb.-thrust Pratt & Whitney J75 turbojet engines used by the F-105, and Transports Aeriens Intercontinentaux (T. A. I.) airline is performing turnaround maintenance for Military Air Transport Service aircraft. Other AMFEA contracts, on a country-by-country basis, include:

- **Belgium**—Sabena Belgian World Airlines, maintenance and periodic inspection of certain USAF cargo aircraft, including the Lockheed C-130 turboprop transport. Beherman-Demon Engineering Co., vehicle repair.
- **United Kingdom**—Number of secondary contracts in the areas of missile early warning and tropospheric scatter. Field Aircraft Service, Ltd., maintenance and crash damage repair on the McDonnell F-101. British Oxygen Aviation Services, contract for the supply of oxygen. British Overseas Airways Corp., overhaul of the Wright 1830 piston engine.
- **West Germany**—Number of secondary contracts. Airepair, portion of the F-102 tail hook installation program. Lear Electronic, a U. S.-owned subsidiary, fire control system components. Knapsack-Griesheim, supply of liquid and breathing oxygen.
- **Italy**—Fiat, production of G. 91s for Mutual Aid recipients. Siai Marchetti, overhaul of Convair C-131 transports and renovation of Fairchild C-119 cargo aircraft for Mutual Aid nations.
- **Spain**—Seven contracts to assist various plants to tool up for the servicing of American weapon systems supplied to Spain and other allied countries in the theater. Spanish communications cartel, administration and operation of communication facilities for all U. S. forces in Spain.
- **North Africa**—Misrair, United Arab Airlines turnaround maintenance of Military Air Transport Service aircraft at Cairo airport. Casablanca area, several contracts for pipeline maintenance



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On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history . . . "FORGING MILITARY SPACEPOWER" – USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, avionic and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or research services to the Air Force.

The Systems Command will control approximately $15 billion in contracts and annually will award $7-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

These are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various bases of the Command for full, complete reports. Detailed edi-

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# MILITARY SPACEPOWER"

# USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961

torial coverage will be given to procurement, organization, plans and programs, policies, procedures and future technical activities.

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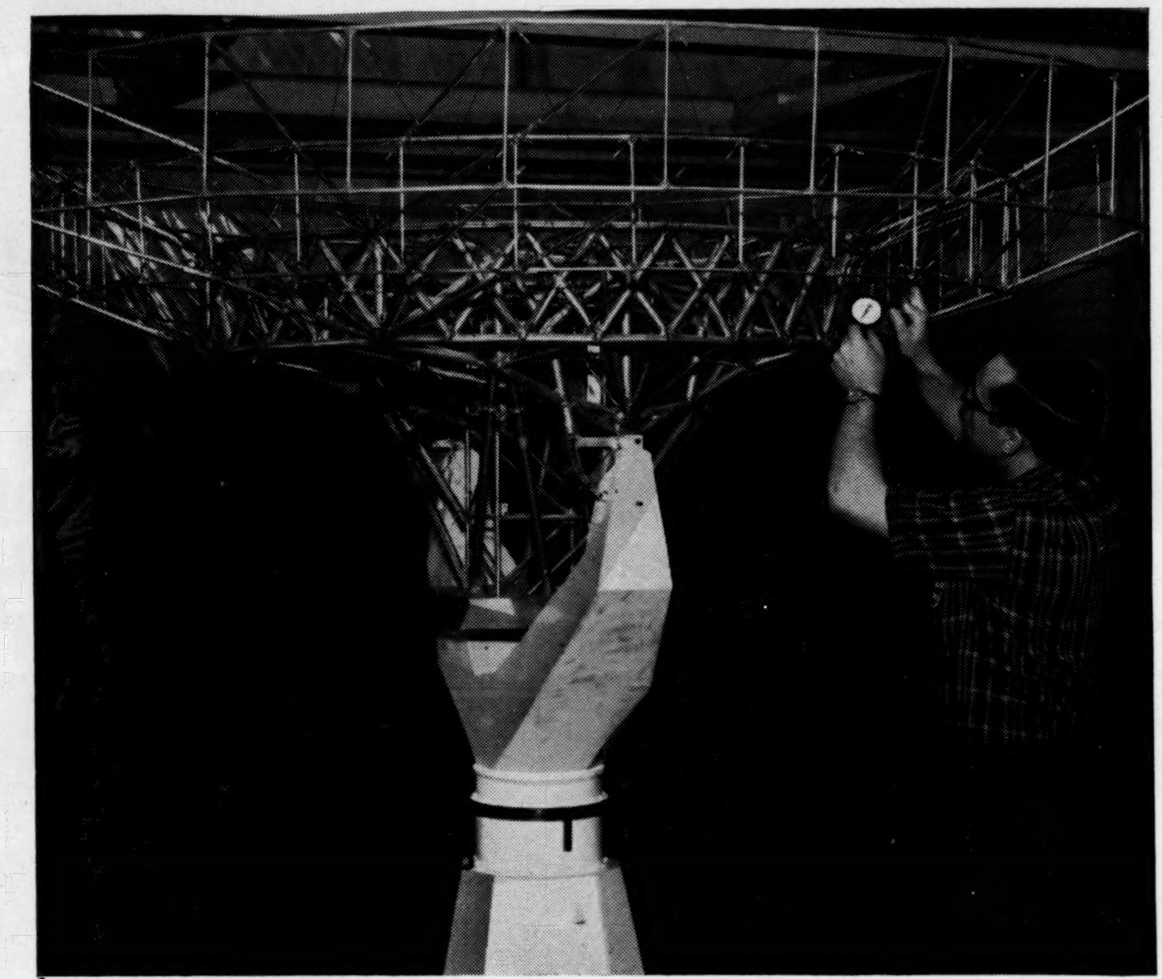

1/15 scale model of 120′ antenna being designed for MIT-Lincoln Laboratory under USAF sponsorship.

# New research and development opportunities for Engineers

Currently undergoing static and dynamic tests at NAA-Columbus is a 1/15 scale model of the 120-foot antenna system which will be located on "Haystack Hill" near Tyngsboro, Massachusetts. It is the purpose of this model to verify predictions of the static deflection under inertial loads as well as to determine the antenna's vibration characteristics.

This antenna model is typical of the efforts expended at NAA-Columbus to ensure that static and dynamic structural deflections of such systems are kept to an absolute minimum to ensure the greatest possible system accuracy.

Engineers with advanced degrees interested in Research and Development directed to the prediction of deflection characteristics of such large ground based systems under static (inertial), dynamic (earthquake, winds), and thermal loads are required immediately.

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and operation and for port handling facilities.

Even small Luxembourg comes in for its share, with a contract for the modification of tip tanks to theater requirements. Contracts in the Middle East, however, are primarily for emergency maintenance of transport aircraft.

Of the operational USAF aircraft now in Europe, all but those of a small Douglas B-66 unit and a Boeing KB-60 tanker group are currently being maintained within the theater. These two, represented in too small numbers to make a European operation economical, return to the U. S. for maintenance as do the rotational F-100, Lockheed F-104 and MATS' squadrons which remain in Europe for only short periods at a time.

In planned support of other functions, Col. Maher's office currently has a number of new requests out for bids by companies in several countries. When a contract is to be let, rather than blanket advertising, Maher's office asks a selected number of companies to submit bids, taking in the usual considerations of capability, present workload, location, etc.

### Familiarity Grows

Prior to Fiscal 1961, most contracts were on a time and material basis. As its familiarity with its contractors grows, however, AMFEA hopes to turn more and more to straight fixed-price contracts and a resultant savings in cost.

To monitor these contracts, Maher's headquarters has field air procurement offices in Wiesbaden, Brussels, London, Chateauroux and Madrid plus a small operation in Turin, Italy.

The Madrid office, as an example, has between 65 and 70 people spread out among the various contract sites, with such specialties as quality control, flight test, contract administration and supply.

Their reports funnel back into the Madrid office and, from there, in consolidated form to Maher so that a current status report on work and progress is always available.

Another AMFEA function is that of on-the-spot evaluator for the Logistic Command and the individual Air Materiel Areas.

If, for instance, an F-104 of the rotational unit in Spain is damaged, normal responsibility for arranging for its repair would lie with the aircraft's prime AMA, in this case Sacramento.

But, as Gen. Price explains, "Sacramento couldn't know what to do over here.

"So we take a look at the plane, estimate the cost of repair and tell Sacramento, 'Send us the money, and we'll get it fixed for you.' "

AMFEA also acts as what Gen. Price describes as the "customer's man" in

Europe for USAF units and for North Atlantic Treaty Organization and Mutual Aid countries on any logistic problems stemming from deliveries from the U.S.

If supplies are slow in coming, AMFEA tries to determine why and eliminate the bottlenecks. It also helps the individual countries in establishing their own networks such as initiating a mechanized supply management system for the Greek air force or analyzing the particular supply requirements of the Turks.

In its role as "customer's man," Col. Bostwick sums up AMFEA's position by saying "we kind of hold the customer's hand."

### Rotating F-100s

As a case in point, he cites a recent instance in which the rotational F-100 wing in Turkey was experiencing a major resupply problem that similar units in Europe were not having. "They couldn't even get answers to their telegrams," Bostwick says.

A complaint was channeled through AMFEA, two specialists were sent to the F-100 base at Adana to work with the wing's materiel people and follow through on a case-by-case basis. "They found," Col. Bostwick says, "that 95% of the trouble was within one AMA." Moves are now being taken in both Europe and the U. S. to try to ensure that there will be no repeats.

Peripheral AMFEA chores include the management of three ammunition depots—in Great Britain, Germany and Italy—as well as a number of subsistence depots which supply food to all the U. S. armed forces within their respective areas. A new mission is that of U. S. "Disaster Center" in Europe in which it maintains emergency supplies of medicine, food and bedding to be flown into countries hit by natural disasters. Management of the UN Congo logistics effort has been an AMFEA function since July, 1960, shortly after that nation was torn by civil war.

### Procurement Field

It is the field of procurement and production, however, from which AMFEA draws its greatest pride. In a recent letter to Gen. Price upon AMFEA's selection as recipient of the Brig. Gen. Nelson S. Talbott Award for outstanding performance in this area, Lt. Gen. William McKee, vice commander of the Logistics Command, said:

"Personnel of your organization are to be congratulated for handling in an exemplary manner complex problems not normally encountered in procurement and production and which required solution by individual initiative without benefit of precedent. . . ."

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## AVIATION WEEK, SEPTEMBER 4, 1961

AEROJET-GENERAL CORPORATION .....2nd Cover, 7
AEROSPACE CORPORATION .................... 3
AIRWORK CORPORATION ...................... 84
ALUMINUM COMPANY OF AMERICA..........54-55
AMP INCORPORATED ......................... 70
ATOMICS INTERNATIONAL, A DIVISION OF NORTH AMERICAN AVIATION INC........... 85
AVCO CORPORATION .......................4th Cover
AVIATION WEEK AND SPACE TECHNOLOGY..88-89

BALL BROTHERS RESEARCH CORP............ 91
BETHLEHEM STEEL COMPANY................ 8
BRISTOL SIDDELEY ENGINES LIMITED......44-45

CANNON-MUSKEGON CORPORATION .......... 12
CLAUSER TECHNOLOGY CORPORATION........ 6
CLIFTON PRECISION PRODUCTS COMPANY, INC. .......................................3rd Cover
COLUMBUS, A DIVISION OF NORTH AMERICAN AVIATION, INC. ..........................58-59, 90
CONSOLIDATED DIESEL ELECTRIC CORPORATION ........................................ 4

DATA CONTROLS SYSTEMS, INC................ 5
DEL MAR ENGINEERING LABORATORIES...... 13
DEUTSCH COMPANY .......................... 9

GARRETT CORPORATION, THE ................ 14
GEMCO INC., A SUBSIDIARY OF THE HUPP CORP. ...................................... 75
GENERAL ELECTRIC COMPANY................10-11
GENERAL ELECTRIC COMPANY, TUBE DIVISION .........................................15, 66
THE B. F. GOODRICH COMPANY, AEROSPACE & DEFENSE PRODUCTS DIV.................76-77
GRAND CENTRAL ROCKET COMPANY.......... 20

HAMILTON STANDARD DIVISION, UNITED AIRCRAFT CORPORATION ..................16-17
HUGHES AIRCRAFT COMPANY ................68-69

LIBRASCOPE DIVISION, GENERAL PRECISION, INC. ......................................... 24
LITTON SYSTEMS, INC. ...................... 91
LOCKHEED AIRCRAFT CORPORATION, GEORGIA DIVISION .............................. 86
LOS ANGELES DIVISION OF NORTH AMERICAN AVIATION, INC. ............................. 97

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY ......................................... 81
MINNESOTA MINING & MANUFACTURING CO. 80

RCA SERVICE COMPANY......................50-51
RCA, ASTRO-ELECTRONICS DIVISION.......... 42

SPACE & INFORMATION SYSTEMS, A DIVISION OF NORTH AMERICAN AVIATION, INC...... 87

TAPCO DIVISION OF THOMPSON RAMO WOOLDRIDGE, INC. .......................... 62
TEXAS INSTRUMENTS INCORPORATED ........ 22

VICKERS, INCORPORATED, MARINE & ORDNANCE DIV. ............................ 18

WIGGINS OIL TOOL CO., INC., E. B............ 84

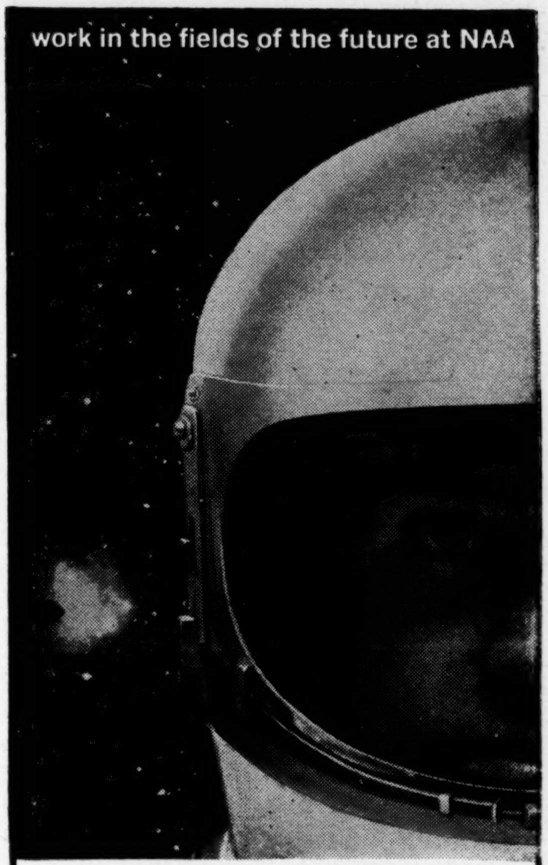
### CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES .............92-96
Books ........................................ 96
EQUIPMENT
(Used or Surplus New)
For Sale ..................................... 96

### ADVERTISERS INDEX

Boreas Corporation ............................ 96
Cape Canaveral Sales Co........................ 96
Cornell Aeronautical Laboratory, Inc............ 94
Gyrodyne Co. of America Inc..................... 95
Radio Research Instrument Co.................... 96
Republic Aviation .............................. 96
Solar Aircraft Company.......................... 92
Stolzfus Agency, Chris D........................ 96
Vertol Div., General Precision.................. 93



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All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

LOS ANGELES DIVISION
NORTH AMERICAN AVIATION

# LETTERS

***Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.***

## Bomber Potential

Your Aug. 14 issue (p. 26) contains an article by Larry Booda entitled, "Soviet Gains Blunt U. S. Bomber Potential." I have carefully studied this article in an effort to find some basis in logic for the conclusions reached therein. Failing in this, I have endeavored to align it with the fine editorials which have appeared in your magazine, many of which I have entered into the Congressional Record, and here too this article simply doesn't fit. To say the least it is most highly speculative.

First, we have plenty of evidence that the Soviets seem to be amply equipped with scientists, engineers and technicians who have demonstrated skill in the art of weaponry. A major difference appears to lie in the obvious fact that they approach a problem with the objective of "why" rather than "why not." At any rate it is safe to assume that they, like any nation, continually test their offensive capability against their defensive capability using the results to refine each. It is perfectly obvious that their military planners are most aware of the principles of warfare. The results of Soviet studies on the future of manned bombers was clearly demonstrated in their air show on July 9 where they exhibited new supersonic manned strategic bombers. Your magazine covered this show in great detail.

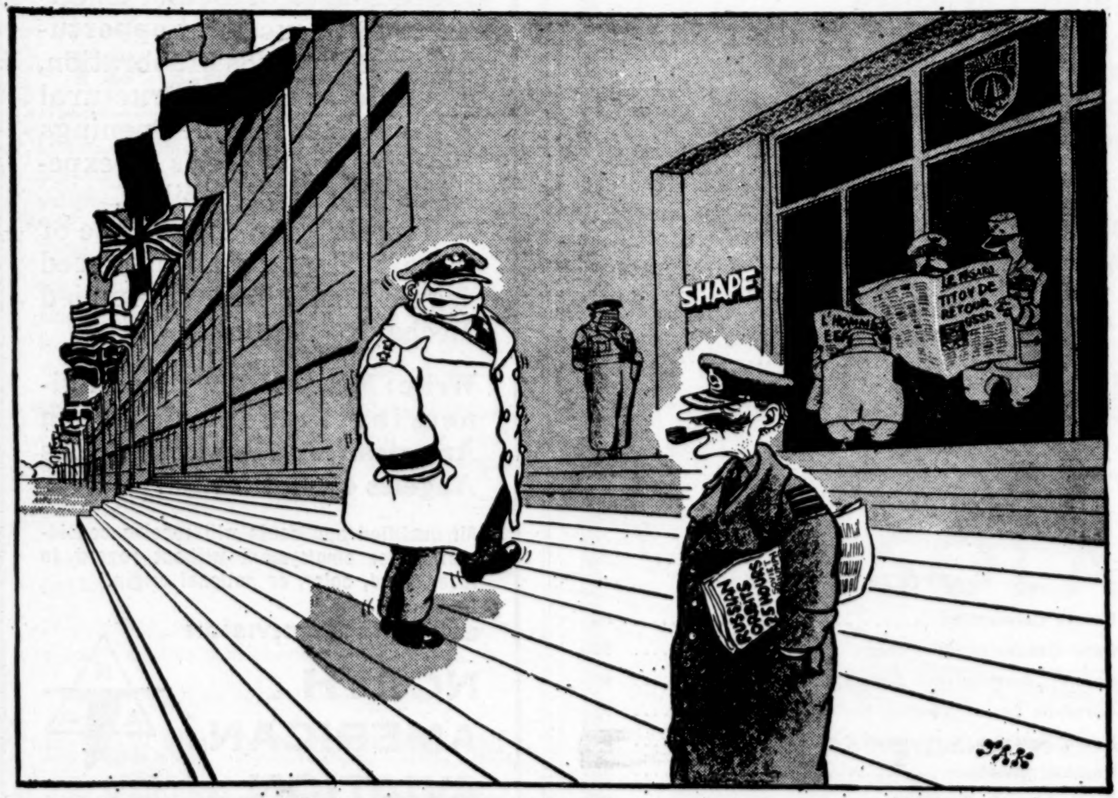
Any defensive weapon always has and always will have finite capabilities and limitations. Careful study of the latter always leaves the door open to the attacker. Using offensive weapons of the maximum flexibility, any determined attacker with the initiative on his side can exploit this flexibility with strategy and tactics so as to confound the limitations of the defense. The more automatic the defensive weapons become the more fixed are their limitations. Our B-58, for example, has repeatedly demonstrated its ability to penetrate our own air defenses and this includes the highly specialized test areas where everything new in defense is given practical tests under the careful operation of the inventing specialists. The B-58 can operate at over Mach .9 on-the-deck or at Mach 2 at extreme altitudes. The pilot can use any combination of these extremes plus maneuverability never before available to a long-range bomber to frustrate the best efforts of the defense. In addition it carries a bag of electronic countermeasure tricks of the most sophisticated nature which it has not yet had to use in eluding our own defense but which have been more than proven in tests. Your article carefully avoids any reference to this weapons system.

If this country should ever reach the point which your article ostensibly credits Secretary McNamara with believing we have reached, wherein our total strategic offensive rests in ballistic missiles, be they Thors, Jupiters, Atlases, Titans, Minutemans and Polaris, we will have performed the greatest service to Mr. Khrushchev possible. We will have simplified his defensive problems to countering missiles of known capabilities with defensive missiles whose capabilities exploit the fixed limitations of the unmanned offensive weapons. As it is, Mr. Khrushchev has an imponderable task. In addition to the missiles mentioned, he must attempt to offset the tremendous offensive might of B-52s equipped with bombs, missiles, electronic and infrared countermeasures and, most important, skilled and intelligent men. He must face the devastating reality of the Mach 2 B-58, whose planform is so small as to almost defy detection by any means, armed with bombs, missiles, most sophisticated countermeasures and intelligent men. When the B-70 is ready it will add a new dimension to his defensive headache. Even the mass represented by the B-47s confounds his problem and limits his world domination objectives to bluster and subterfuge.

Let us pray, Mr. Editor, that our Defense Department is never swayed by such illogic as this article displays.

Rep. Jim Wright
Member of Congress
12th District, Tex.

*(The story referred to by Congressman Wright is a reporting job of detailing the views of Defense Secretary McNamara on the future value of manned bombers and the information on which he is basing those views. It does not necessarily represent the editorial opinion of* AVIATION WEEK.—*Ed.)*



"YOU CAN TALK, BUSTER; WHATEVER HAPPENED TO BLUESTREAK?"
*Courtesy London Evening Standard*

## Tushino Coverage

Your editorials are normally pretty good, but I want to tell you that "Lessons of Tushino" (AW July 17, p. 21) is superb. It is the old story—we can do anything we decide we want to do—and decisions are the hardest things to get in our society.

I suppose you sometimes wonder whether anybody is listening, but I hope you keep it up. Illegitimus non carborundum.

J. R. Dempsey
President
General Dynamics/Astronautics
San Diego, Calif.

I know I am joining a number of people in the aviation industry who have already congratulated you for your editorial "Lessons of Tushino" in the July 17 issue.

Perhaps we in the helicopter segment of the aviation industry got a special kick out of the beautifully written editorial because if applied so directly to our particular niche of vertical flight, just as well as it applied to long-range interceptors and supersonic attack bombers. In fact, substitution of a few proper nouns would make the editorial almost perfect as a summation of the U. S.-Russian helicopter and VTOL competition.

As the first editorialist who has responded in this incisive manner to the Tushino publicity party, you have the respect and backing of those of us in the industry who don't need Tushino's and 10-year old information to convince us of the urgency for solid, realistic aviation development programs which have a solid, resolute beginning and which result in a solid, practical family of aircraft at the conclusion.

Those of us in the industry and military who are now working toward this end with our sleeves rolled up don't want them pulled down again, and we seek your continued editorial courage to cut directly into our country's technological problems, in the time we appear to have remaining.

John F. Straubel
Public Relations Manager
Hiller Aircraft Corp.
Palo Alto, Calif.